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THE ALPINE RACES IN EUROPE.*

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This paper is an attempt to interpret the admitted distribution of human types in Central and Eastern Europe, both in modern times and in successive periods of antiquity, partly in connection with similar though scantier evidence from adjacent regions of Western Asia, partly as conditioned by changes in the distribution of land and water, and of climate and vegetation, which are indicated by recent work in palæogeography, as far back as the Ice Age and the period immediately preceding it.

For convenience of reference, I propose to limit myself almost exclusively to data which are accessible in a few standard works and fairly well-known papers: for anthropology, to Deniker's 'Races de l'Europe,' 1897; 'The Races of Man' (E. T.), 1900; and his Huxley Memorial Lecture (1904) in *Journ. Anthr. Inst.*, **34**, 1810; and to Ripley's 'Races of Europe,' 1900: in palæogeography, to Suess, 'The Face of the Earth,' 1 (E. T. Oxford, 1904); and to Ratzel's papers, "Die Ursprung und Wanderung der Völker geographisch betrachtet," in *Ber. ü Verh. d. k. Sachs. Ges. Wiss. Leipzig*, **50** (1898), **52** (1900). It is to the last named that I owe the suggestive treatment of the conditions in Eastern Europe, which started me on the present inquiry.

On the statical aspect of the matter there is practical unanimity, though the evidence is still incomplete here and there, and in detail. Presentations of the anthropology of Europe as different superficially as those of Ripley and Deniker agree on closer analysis in recognizing three main types: (1) the long-headed dark *Homo Mediterraneus*, bounded northwards by the Alpine barrier, but with littoral offshoots along the Atlantic seaboard; (2) the long-headed blonde *H. borealis*, disposed

* Research Department, March 9, 1906.

round the Baltic and North sea, in an oval of about 1500 by 2000 miles; commingling westward with the littoral extension of *H. Mediterraneus*, and showing traces of a large south-eastward extension also in comparatively recent times; and (3) a rather variable but broad-headed type, generally brunette, which from its wedge-like distribution westward from a base between the Adriatic and the Dnieper to an apex in Brittany, and from its general coincidence of distribution with the main mountain zone of Central Europe, has acquired, rightly or wrongly, the name of *H. alpinus*. Between *H. Mediterraneus* and *H. borealis* a general affinity is commonly admitted; the evidence of palæanthropology supports this relationship strongly; and that of the palæogeography of quaternary Europe makes it practically certain that both types may be traced back to an Eur-African origin.

There is general agreement, also, that the broad-headed *H. Alpinus* is of incomparably remoter relationship to these long-headed types. Keane, indeed, argues recently for a North African origin for *H. alpinus* also, quoting a broad-headed strain among the ancient Guanches, and a similar patch still between Tunis and Tripoli. But the common beliefs are either that *H. alpinus* originated locally in his Alpine habitat by some physiological response to climate, altitude, or other geographical circumstance, or that his origin must be sought further east in some part of Asia. The latter view is supported by the enormous preponderance, over Asia, north of the Himalayan chain, of excessively broad-headed peoples, and by the extension of such types, in their modern statical distribution, over the whole of the Eurasian steppe, and sporadically over most of Irania, Caucasia, and Anatolia. But the evident expansion of these Asiatic broad-heads from centres of distribution which are exclusively in very high altitudes, gives new weight to the former contention that in the European highlands also broad-headedness *may* be a feature acquired both locally and recently.

This former hypothesis is clearly not a matter of geography, but of physiology, and I do not propose to consider it further, except to remark that the present state of our knowledge as to the rate of alterability of a deep-seated structure like the human cranial skeleton offers very little encouragement to believe either that the area of highland in Europe is large enough to permit the local evolution of a marked human variety of this kind, or that the time which has elapsed, since the retreat of glacial conditions made this highland habitable, has been at all long enough to allow of so considerable a change of head-form, even if the area available eventually had been large enough or secluded enough for the purpose.

I propose, therefore, to assume that *H. alpinus* in Central Europe has come from somewhere; that, like the long-headed types, he has reached the greater part of his present European habitat within post-glacial times; and that, except on an hypothesis of spontaneous

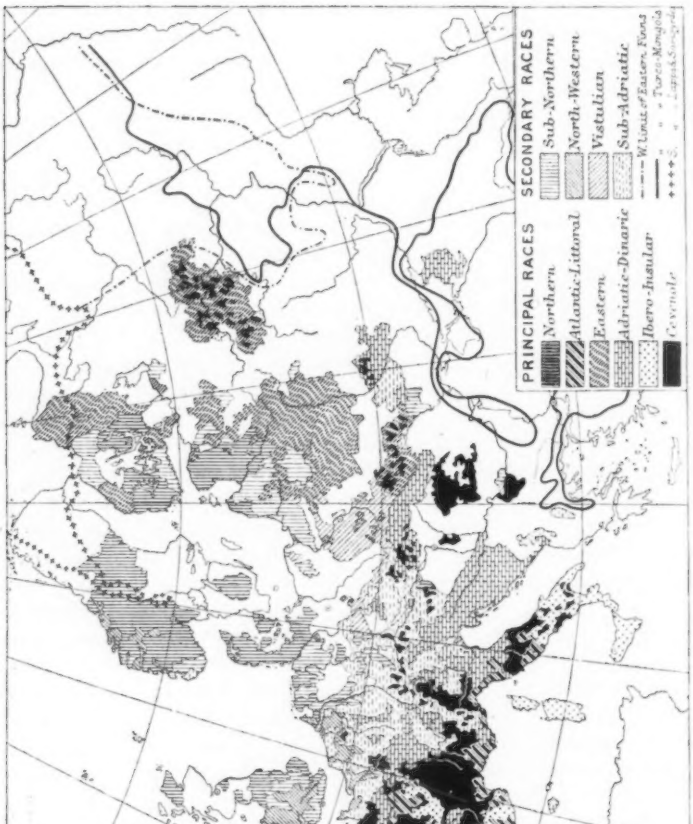
generation such as we have already seen reason to reject for Europe, it is difficult to accept Keane's view * that his original home was in North Africa. Keane's instances of survival of broad-headed man in this direction will, moreover, be found susceptible later on of adequate explanation on a quite different Alpine hypothesis. A glance at the general distribution of types of head-form, and even of pigmentation, over the land-surface of the Old World reveals a *primâ facie* case for the hypothesis that the sallow dark-haired broad-heads of the West stand in some not very distant relation to the broad-heads of Central Asia; distinct as the latter are in their almost hairless face, exceedingly yellow skin, and peculiar conformation of eye and brow. But if "somewhere in Asia" is the ultimate home of the western broad-heads, what was the line of their route, and what were the geographical conditions during the period of their transit?

The plateau core of Asia is connected now with the mountain core of peninsular Europe by two distinct lines of communication; the Eurasian steppe, and the Anatolian and Iranian section of the Alpine-Himalayan fold system. From the point where they leave the western limits of Inner Asia, these two lines of communication lie for a while conterminous; but about midway in their course they are held apart by the Caspian depression, and then again, after another brief interval of Caucasian contiguity, by the sea of Azov and the Black sea.

Both routes have served in historic times as lines of immigration from Inner Asia to Eastern Europe; and both are marked now (quite apart from spasmodic incursions) by a graduated transition of racial type among their permanent if not sedentary inhabitants. The northern series passes by gradual changes from the typically Mongoloid peoples of the Kirghiz and Turkoman steppes to the Finns and Slavs who border respectively the Baltic and the Pontic shores of the isthmus into peninsular Europe; and whose physical types, as they are traced westward, betray respectively the growing proximity of the Baltic and the Carpathian citadels—of *H. borealis*, that is, and of *H. alpinus*. The southern series passes likewise from the Tajik and Galcha peoples on the western fringe of Highland Asia, through the Armenoid types of Caucasia and Anatolia to the Albanians and other "Dinaric" broad-heads of Deniker's classification, and so on to the short-heads of the Alpine region and their westward colonies in Central France and Brittany.

* 'Man Past and Present,' p. 457: "Here again we see how unnecessary it is to go to Asia for the early European roundheads, who are generally introduced from the east in the Bronze Age, although it is clear that large numbers had already established themselves in Central and West Europe during the New Stone Age." And again, p. 458, he speaks of "great invasions of dark or brown roundheads of average size (probably from the Iranian uplands). But all of these had themselves first been specialized in North Africa, the true centre of evolution and of dispersion of all the main branches of the Caucasic family."

Throughout historic times the northern route has had, for European peoples, an overwhelmingly greater importance politically, and has worked also an incomparably greater change in the recent ethnography



of Europe than the southern; and it is probably this practical necessity of taking political account of this northern route which has permitted its predominance in anthropological theory also. When a people, or

a language, or an idea, not demonstrably "Mesopotamian" or "Semitic," is claimed as having migrated into Europe from "somewhere in Asia," it has been presumed almost invariably that it arrived in peninsular Europe from the north-east; and conversely, when attempts have been made to derive "Aryan" phenomena in India or Persia from an ultimate source in Europe, it is usually north of the Caspian that their course is traced.

It is to Ratzel, I think, that the credit belongs of demonstrating, in the paper already quoted, the relative modernity of this northern line of communication. The steppe route was, in fact, non-existent until two conditions were fulfilled: (1) the retreat of the glacial ice-cap from the basin of the upper Dnieper, upper Don, and upper Volga; and (2) the restriction of the Sarmatian, or Ponto-Caspian sea, to its modern Caspian limits, so as to connect the European steppe, from Carpathians to Volga, with the Asiatic steppe from Altai to the foot of the Urals.

Ratzel used his reconstruction of the geography of Eastern Europe during and since the Ice Age, to explain how Europe became isolated sufficiently, and long enough, to permit of the evolution of *H. borealis* as a gigantic blanched variety of the precursor of *H. Mediterraneus*. But he has not indicated clearly whether he realized that another corollary follows from his geographical conclusions; and it is this other corollary which I hope to develop in what follows. Meanwhile it is important to note, also, that even in regard to the northern route Ratzel does not state the case against early Asiatic immigration at all so strongly as the facts seem to justify. Not merely was it possible, long after the stage of European history when broad-headed man is traceable in the neolithic lake-dwellings of western Switzerland and Austria, for the overwhelmingly long-headed folk of the *kurgans* to range nomadically over a secluded steppe from the Carpathians to the west bank of the Volga, and to lay the foundations of the ethnography of the north-western Caucasus, but, as soon as the shrinkage of the Caspian had gone on long enough to open a steppe-route into Asia, it was the European long-headed steppe-people which carried its *kurgan* interments north-eastward as far as Tobolsk, and distributed those patches of relatively long-headed blondes which survive even further afield. There is, in fact, no positive evidence of any but long-headed nomads on the European steppe until a period which is far on in the Bronze Age of this region; and probably not until the so-called "Scythic" movements at the beginning of the Age of Iron. Now, if the steppe route was thus securely closed until this late date, as the ethnography and the geography of the region combine to prove that it was, we are thrown back upon an examination of the parts south of the Caspian for a possible means of access of broad-headed people to Europe.

At first sight we are met by a precisely similar obstacle, geographical and ethnographical. The highlands, which are continuous from the Pamirs to Phrygia, are divided from the Balkan and Dinaric highlands by the Hellespontine depression and the Ægean sea; and though the former, in its present state, has never been a barrier to man, it was certainly somewhat more deeply submerged—at least up to the 150-feet line—in late Quaternary time, just when the broad-headed peoples, if they were of Anatolian origin, ought to have been free to enter the Alpine region. Moreover, from the later Stone Age onwards the activity of the blonde long-headed nomads of the European steppes can be traced very clearly south-westwards also, intruding by way of the lower Danube upon the Balkan lands, and establishing themselves with their characteristic *kurgan* tumuli all over Thrace, over a large area on the karst plateau of Bosnia, and even over a considerable part of Western Asia Minor, from the Hellespont southwards to Lydia and Caria, and eastwards up the Sangarius into plateau Phrygia. In Bosnia this long-headed population lasted on until the early Iron Age, or somewhere about 800 B.C.; in Thrace, fair-hair and tumulus-burial could be seen still, about 450 B.C.; and from the Danube mouth to Varna a markedly blonde and long-headed population survives to the present day. At this point, therefore, it would seem as if northern and Mediterranean long-heads met once more and nipped off our Alpine broad-heads from their nearest Anatolian affinities. Here, however, the earlier history of the people and of the area throws a different light on the matter.

In regard to the geographical factors, Ratzel and Suess are only summing up a consensus of recent inquiry when they emphasize the very recent date and summary character of the subsidences which let down certain areas adjacent to Asia Minor to their present level. These areas are (1) the whole south lobe of the Caspian, south of Baku and Krasnovodsk in lat. 40°; (2) the whole Black Sea basin south of a line joining the Caucasus with the Crimean Yaila, and this with the Balkans behind Varna;* (3) the whole Ægean basin, from the submerged Cycladic ranges northwards, and therewith the sea of Marmora; (5) the whole (probably, and certainly the south-eastern part) of the foreshore of Syria on which Cyprus stands, as far west as a line drawn from Adalia to Alexandria. Suess quotes one rather doubtful case of the discovery of a human implement in Hellespontine shore-deposits of the period of greatest subsidence, approximately at the culmination of the Ice Age; and thinks that "it is even possible that these events were witnessed by man;" and certainly the anthropology of Cyprus gives the strong impression that the island was already inhabited by

* It is a matter of detail when and how the Mediterranean came to receive the drainage of this area, and of the far older Sarmatian sea which survives in the gulf of Odessa and the sea of Azov.

EUROPE
showing
DISTRIBUTION OF HOMO ALPINUS
AND DERIVATIONS
Data from Deniker, but with shading revised, and non-European elements added in outline, mainly after Ripley
Scale 1:50,000,000
Statute Miles

EXPLANATORY DIAGRAM

FIG A DENIKER'S NOMENCLATURE	PHYSICAL CHARACTERISTICS Head Form	Colouring	Stature	GROUPING NOW PROPOSED FIG. B
Ibero-Insular	Dolicho	Dark	Short	MEDITERRANEUS Ibero-Insular
Atlantic-Littoral	Meso	"	Tall	Littoral
Adriatic-Dinaric	Brachy	"	"	Adriatic-Dinaric
Sub-Adriatic	"	Less Dark	Less Tall	Sub-Adriatic
Cevenole	"	Dark	Short	Cevenole
Eastern	"	Fair	"	Eastern
Vistulian	Meso	"	"	Vistulian
Sub-Northern	"	"	Tall	Sub-Northern
Northern	Dolicho	"	"	BOREALIS Northern
North-Western	Sub-Dolicho	Brown	"	North-Western
	Brachy	Dark	"	Adriatic & Sub-Adriatic (v. above)
"Turco-Mongol" (Turkish half)	"	"	"	Balkan-Anatolian "Armenoid" area
" " (Cossack-Tatar half)	"			Mongoloids of Steppe
"Eastern Finns"	"			" " Forest
"Lapps & Samoyedes"	"			" " Tundra

(ALPINUS)

man of North African type, before it was cut off finally from the mainland. The problem, also, of the introduction of *H. Mediterraneus* into the Ægean would be considerably simplified if it were permissible to suppose that, down to the glacial submergence, it had land communication, past Rhodes and Lycia, with the lost Syrian foreshore.

Whether we admit for our present purpose a larger or smaller width of isthmus between Anatolia and the Balkan lands, the conclusion remains that in immediately pre-glacial times, and far on into the period which corresponds with the Ice Age of Northern Europe, we must presume the existence of a promontory of Asia, much broader, but not much more elevated than the present Asia Minor, barred southward, as at present, by the Eastern Mediterranean as far east as Lycia; further east by a prolongation of the Persian gulf far up the present Mesopotamian "Lombardy;" and in the intervening section by the abrupt south face of Taurus. Internally this great promontory consisted of alternate mountain ridges and intermont plateaux, more or less uniformly dotted with considerable lakes; for the Sarmatian or Ponto-Caspian sea on the north, the Mesopotamian gulf on the south, and the excessive humidity of the glacial "penumbra" combined to give abundant rainfall, and the modern river gorges of Halys, Sangarius, and the like, were far less completely excavated than now.

By an isthmus, if it can be called so, at least as broad as from the Bosphorus to Eubœa, and not improbably from Varna to Attica, this great Anatolia extended west as far as the Iron Gates and Montenegro. Beyond this only two things are clear: (1) that continuous highland, broken, if at all, only by an early stage of the Danube gorge, ran northwards, and then westwards along the Carpathians, enclosing a Hungarian lake; (2) that west of the Hungarian lake a long highland promontory ran out almost to nothing where it made touch with the Eastern Alps. It is not certain, however, exactly at what point in the break up of this continental *régimé* the upper Adriatic collapsed; and we have to be prepared for the possibility that a foreshore like that of Syria connected the Dalmatian highland with the foot of the Apennines. All this Balkan section of the Anatolian region repeated on a smaller-featured scale the tangle of ridge and lake-land which we have seen to be characteristic of Asia Minor. We must also remember that further east, in what is now northern and central Irania, far more favourable conditions prevailed, so long as the Aral-Caspian sea was in existence; and that the configuration of this land also offers just the same foundation for a *régimé* of lake-basins as does Anatolia itself.

We have, therefore, all the conditions for the development, in immediately pre-glacial time, of a distinct type of man—a great expanse of uniformly diversified country, adequate rainfall, moderate climate, ample forest on the highlands, grasslands, with good evidence of the presence of domesticable cattle, round the lakes; and, in

particular, a peculiar abundance of edible fruits—quince, mulberry, olive—especially its characteristic stone fruits, from cherry and plum to apricot and peach; and nuts, such as chestnut and walnut. The last point is of importance, because, if current speculations as to the influence of jaw-power on skull-form, and of diet upon the need for jaw-power, are leading to valid results, as I think they are, a diet of masticable fruits may well have been one of the conditions for the development of Anatolian short-headedness, even before the domestication of cattle and the acquisition of a milk and cheese diet like that of the Mongolian peoples.

We have next to consider the effect of glacial conditions on this Quaternary Anatolia. First, though in the latter part of the Ice Age the great subsidences were beginning, there is nothing to show that the general submergence of the Mediterranean coasts extended more than about 150 feet above the present sea-level; so that the gravels of the Hellespont and of Salonica, for example, need not mark more than the course of comparatively narrow gulfs or flooded valleys. Second, so long as the Sarmatian sea remained continuous and wide, as Ratzel shows—and, still more, so soon as the Pontic depression began to take place—the climate of Anatolia must have been comparatively little affected by the pressure of the European ice-sheet; and, in fact, definite traces of glaciation are absent, not only from Anatolia (apart from its present snow-peaks), but from almost all its Balkan continuation as well, though the evidence here is not at all so clear, especially as to Bulgaria or the southern Carpathians. But the open Adriatic and the Hungarian lake probably exercised a certain mitigating effect on all this western section. Further west, however, the Alpine region was certainly very heavily ice-capped; and this ice-cap, together with the Hungarian lake and the snow-clad Carpathians, remained a very serious obstacle to the intrusion of European man from the north-west, when the ice-sheet intermittently retired and gave him access to a strip of tundra country between itself and the Alpine glaciers.

Now, under these conditions two things may reasonably be inferred: First, that in Anatolia and Irania, which were more than ever isolated from Africa and Arabia by the subsidence of the Syrian foreshore and the deeper submergence of Mesopotamia, but were preserved in comparative comfort by southerly latitude and peninsular character, Anatolian man continued to develop favourably and emphatically into a well-marked and well-grown variety. Second, that in so far as Balkan Asia was affected by the Ice Age at all, it was in the direction of partial isolation and relative climatic rigour. And it seems to be admitted (1) that one of the first physiological effects of climatic rigour upon man is to dwarf his stature; (2) that exposure to "alpine" conditions tends to diminish pigmentation, and eventually to lighten the hair-tint. This, at all events, is the current explanation of the blondeness of

H. borealis, and of the prevalence of blonde types among the highlanders of brunette North Africa.

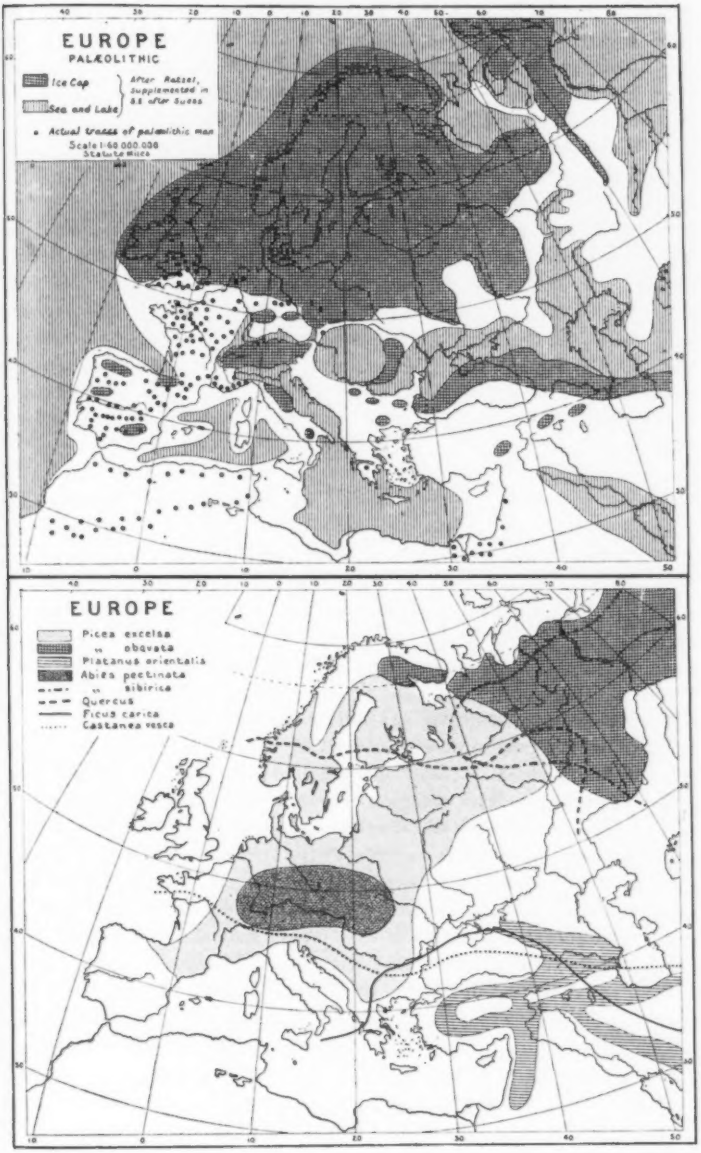
Now, one of the stumbling-blocks of the student of *H. alpinus* has always been the extraordinary distinctness of the gigantic "Dinaric," or Albanian variety, and the dwarf short-limbed "Cevenole race" of Deniker, as we find it in Central France, in Savoy, in Bohemia, and in certain parts of the south-eastern Carpathians, and again sporadically even further north-east in Galicia and beyond Dnieper. And it has long been clear that the "Dinaric race" shares its giantism, as well as its general physique of head and face, with the members of the Armenoid and Caucasian groups of short-heads. But clearly, if our analysis of the Ice Age geography is correct, this difference of stature among broad-headed peoples in Europe is exactly what we ought to expect; and analysis of the circumstances of the succeeding phase of geography and climate will show further how this original distribution, with dwarfs to the west, and giants to the east of the incipient Ægean, is postulated exactly by what happens next.

There seems no reason to doubt that the first repopulation of post-glacial Europe took effect from the west eastward. The Atlantic seaboard had always been preserved by its littoral climate from excessive glaciation; and West Europe had far better communication with the then temperate zone of North Africa than Central Europe had with Balkan Anatolia; thanks to the way in which the Alpine and Carpathian snow-caps, and the Hungarian lake, barred the road from the south-east. Moreover, palæolithic man, of the long-headed types which eventually spread into Bohemia and Northern Hungary, had already a long interglacial training in *tundra* life, and experience of the ways of the large fauna, which he seems now to have followed on their return to the north-east.

After the tundra, the steppe; and throughout all the period of steppe-formation in Europe, and also as long as any exclusively European steppe remained, along either the Baltic or the Ponto-Caspian foreshore, blonde long-headed man remained in secure possession of it.

Such gradual changes of head-form as are shown in the later palæolithic stages in France, as in the race of Laugerie-Chancelade, with its cephalic index of about 74, are more than accounted for by the arrival of an improved strain of Eurafrican man; for the modern Berber index rises as high as 76·5. And against this is to be set the arrival also of the race of Cromagnon, with its index reduced to 73 or less. It is only, therefore, in such very exceptional cases as the two late palæolithic skulls from L'Homme Mort in Lozère, with indices of 78·53 and 78·85, that it becomes necessary to look in any new direction for a source of fresh blood.

By the close of the palæolithic age in Western Europe, however, the whole width of the Alpine foothills was disengaged from its ice-

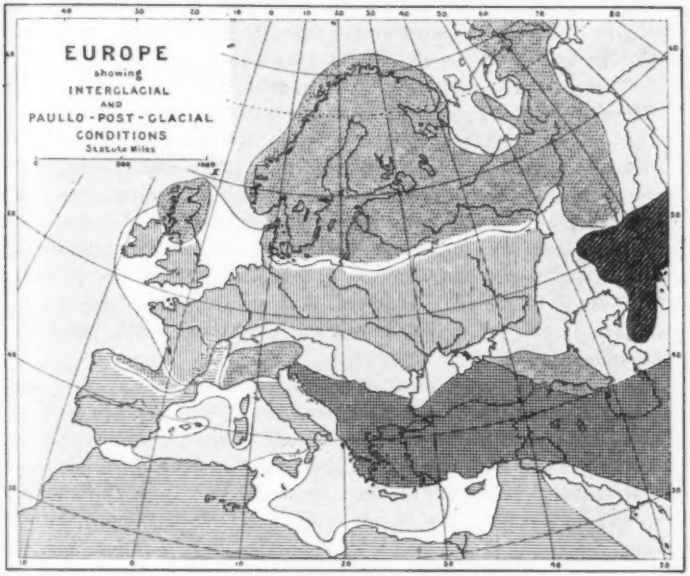

EUROPE
PALÆOLITHIC
Ice Cap
Sea and Lake
After Ratzel, supplemented in S.E. after Suess
Actual traces of palæolithic man
Scale 1:60,000,000
Statute Miles
EUROPE
Picea excelsa
" obovata
Platanus orientalis
Abies pectinata
" sibirica
Quercus
Ficus carica
Castanea vesca

cap; the Hungarian lake was largely transformed to steppe, and the Carpathians and Balkans had assumed nearly their recent appearance. The Adriatic had its present form, save that the Po shore-line was less far advanced, and that all as far west as Piacenza, if not even further, was impassable swamp, bordered by dense forest from the base of the Alpine foothills. Under these circumstances the whole north front of the Balkan lands was thrown open for an advance from the south-east, provided only that the dwarfed short-heads were qualified by their recent mode of life to take advantage of the new situation.

And this is exactly what had happened. Subsequent desiccation has greatly altered the surface-covering of large parts of the Balkan lands; restricting the forests, filling the lakes with detritus from unmitigated rainfall, and so reducing still further the available surfaces of water in the interior. This desiccation naturally affected the interior earliest, driving out trees and water-supplies from the *Axylon* towards the coast-line. But the recent appearance of the Alpine lakelands, and even of parts of Anatolia, recalls what once was general. Now in a heavily forested lake-land practically no mode of civilized life is possible except on the margins of the lakes; and as soon as the process of obstruction of the lakes by detritus sets in, expansion becomes easy lakewards; here alone, also, is there safety at all times from forest dangers, and sooner or later a "lake-dwelling" culture emerges. Now, it can hardly be an accident that it is round the periphery of old Anatolia that we have in classical authors the majority of the descriptions of this type of culture, surviving into historic times; namely, round the Armenian Phasis, the North-Syrian Orontes, the Thracian Strymon, and locally on the lower Danube. And it can hardly be an accident either (1) that the first purely broad-headed population of which traces remain in Central Europe is that of the Swiss lake-dwellers, which is first recognizable in a fairly early neolithic stage; (2) that the first traceable invasion of Italy from the north is effected by broad-headed lake-dwellers, whose mode of life is the only one which enabled them to circumvent the triple frontier of the Alpine and Apennine forests, and the swamps of the Po valley; (3) that the area over which the lake-dwelling culture spreads—more or less modified by circumstances as it goes—is very nearly coincident with that over which the first well-marked intrusions of broad-headed peoples can be traced; (4) that, together with the Alpine lake-dwellings, comes the earliest positive record of a number of characteristic Anatolian fruits, particularly peach, plum, cherry, and chestnut. The actual distribution of the last three is particularly instructive in this respect.

While the Alpine front of the Balkan lands was thus thrown open for the expansion of the dwarf broad-heads of what was now South-Eastern Europe, the disappearance of the large Pontic area, and the desiccation of the rest of Anatolia, are sufficient causes for an exodus

of the giant broad-heads thence; and at this point we have to remember that after the great submergence and the close of the Ice Age came a period of appreciable elevation, which, while it carved out finally the deep *rias* coasts of the Ægean, and gave the Hellespont and Bosphorus their present depth, provided a broad-fronted Hellespontine bridge,


EUROPE
showing
INTERGLACIAL
AND
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CONDITIONS
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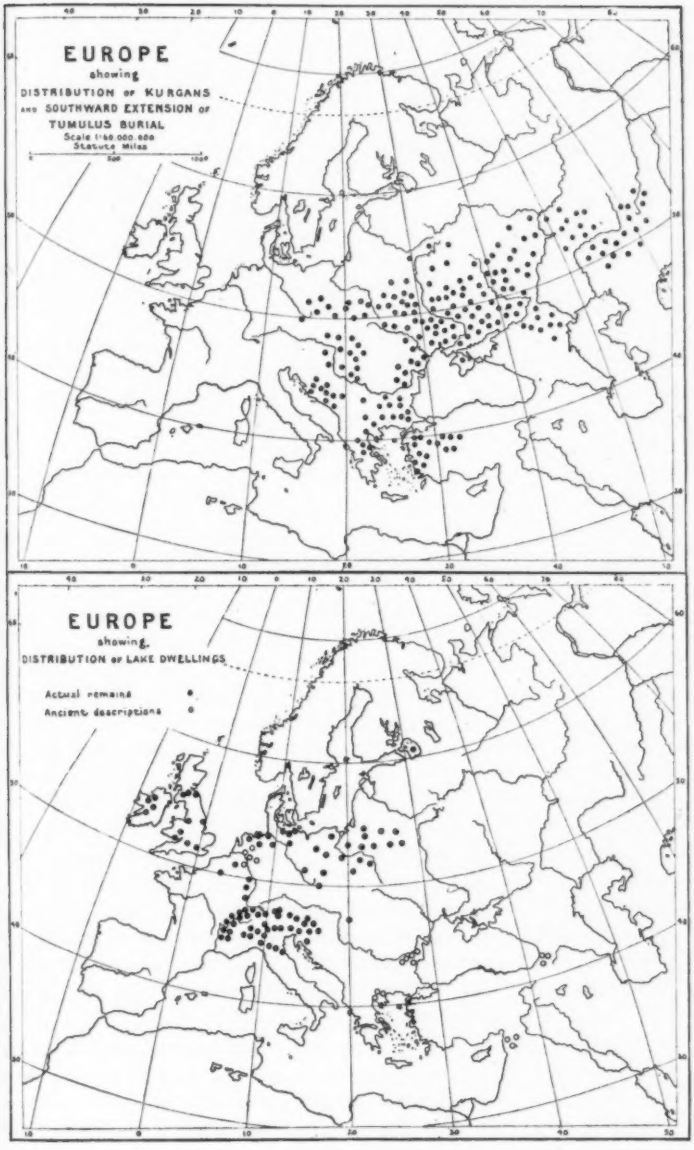
Reference
Sea and lake basins during phases of maximum land-elevation
Shrunken ice-caps: N.B. fringed with debris and tundra
Probable distribution of Palæolithic predecessors of H. borealis
" " " predecessors of H. mediterraneus, pressing N.W. from an African home in succession to H. borealis, and N.E. as far as the barrier of Taurus
The isolated Balkan-Anatolian region suggested as the broad-home of H. alpinus
First area of advancing mongoloids

once more, between Anatolia and the Balkan lands. It is not surprising, therefore, to find distributed thickly along the westward road, pioneered by the "Cevenole" broad-heads, a copious "Dinaric" population, flooding round and beyond the isolated remnants of the older strain, which lie on either side of its path. Nor is it surprising to find Deniker marking an independent patch of "Dinaric" peoples east of the sea of Azov; for the Caucasus was by this time at least as passable or

circumventable as it is now, and a Caucasian—that is, North-East Anatolian—population overlies in this region the early long-heads from the European steppe, while itself underlying the yellow beardless round-heads from the steppes of Asia. It would be tempting to bring into the same connection the strikingly Albanian-looking Tatars of the Yaila, as an early patch of people isolated here since the break-up of the Pontic edge of Anatolia; but the historical intrusion of European Albanians into the Crimea quite recently makes this comparison dangerous, and there is at present no adequate record, I think, of skulls from pre-Hellenic tombs in this quarter.

There is general agreement as to the subsequent course of events in Central and Western Europe. Generally speaking, the stunted "Cevenole" broad-heads have preserved their individuality—for, if our theory is right, they arrived earlier, when the country was more densely obstructed, and more sparsely populated; while the giant "Dinaric" stock, arriving later, penetrating further, and intermixing more with *H. borealis*, has taken on a blonde exterior, while retaining much of its physique and head form; and has thus given rise to many local varieties of rufous half-breeds ("Celts") and much perplexity among ethnographers.

North-eastward the course of events was different. The modern race-map gives us Deniker's "Eastern race," with blonde exterior allied to low stature and broad-headedness, distributed widely through the zone of swamp and forest from the outer foothills of Galicia along the watershed of European Russia. Eastward this type, in its earlier days, was bounded by the blonde long-heads of the steppe and the *kurgans;* westward it has been always exposed to infiltration from the side of the blonde long-heads of the Baltic; only at its Carpathian starting-point, and towards its north-eastern extremity, does it betray its composition and its origin, by the persistence in its midst of a larger percentage of short broad-heads, who are also dark, whom Deniker identifies, probably rightly, as genuine "Cevenoles." What has happened, clearly, is this: along the Carpathians the short Cevenole type spread early, and was only partially swept aside by a "Dinaric" after-flood. For in a region of more rigorous climate, of great swamps, and of forest beyond, between steppe on one side and tundra on the other, this hardier and more truly "Alpine" type was in its element still; and here, in more obstructed country, its "Dinaric" kinsmen could not follow when the time for inter-mixture came. Consequently, here alone we are confronted with a type which is at the same time blonde and broad-headed and short; and, consequently, also, further north, where neither the blonde Baltic-man nor the blonde *kurgan*-man could keep pace, we recover these distant colonies of "Cevenoles" in the great forest, like the Finisterre Bretons, the Walloons, and the Zeelanders in the recesses of the Far West.


EUROPE
showing
DISTRIBUTION of KURGANS
and SOUTHWARD EXTENSION of
TUMULUS BURIAL
Scale 1:50,000,000
Statute Miles
EUROPE
showing
DISTRIBUTION of LAKE DWELLINGS
Actual remains
Ancient descriptions

Two other problems remain. At an earlier stage we traced the *kurgan*-people as early as late Neolithic times south-westward into Balkan lands, as far as Bosnia and Thrace, and even into western Asia Minor. How does this agree with the hypothesis of an Anatolian origin for the Dinaric type? And, further, how are we to account for the presence, again since late Neolithic times at least, of a pure population of *H. Mediterraneus* in the Ægean? The answer in both cases is the same. As in Switzerland, for example, it is quite possible, within a comminuted highland once partly cleared of its forest, for many invasions to take place from steppe to the north, or from an island fringe to the south: in the latter case, without affecting the population of the interior; in the former, without touching, at all, whole districts which retained adequate natural frontiers of mountain or forest. In the case of Thrace or Phrygia, the broad river-valleys —Danube, Axius, Hebrus, and Sangarius—were occupied permanently, and so was the *Axylon*, in the heart of Asia Minor, and the bare karst plateau in Bosnia. But in Albania a broad-headed population of very pure type, and apparently of immemorial antiquity, remains; in the swamps of the Strymon, lake-dwellers lived on into the fifth century B.C., and alongside the patriarchal pastoral Phrygians, the western mountains, and even some retired lowland districts of Anatolia, remained devoted to matriarchal institutions and cults, such as would better fit the more agricultural parts of Africa. It should also be added that, while we have copious legends of migration from Thrace to Phrygia, we have also more than one tradition of "Amazonian" invasions of Thrace, of the conquests of Sesostris in Europe, and of a mysterious migration of Mysians and Teucrians from Anatolia into Thrace, among whose colonists were the lake-dwelling Pæonians round Lake Prasias. Is this also possibly one of the senses in which "Pelops" was a "Phrygian"?

The case of the Ægean peoples of "Mediterranean" origin is similar. All we really know at present about the earliest population of the Ægean is this: first, that the islands were purely long-headed down to the early Iron Age; second, that the fringe of Eastern Greece, Argolis, or Attica were long-headed also; third, that in Lycia there are long-headed and broad-headed people side by side now, uncombined after all these centuries; fourth, that splendid as the cultural superiority of the South Ægean peoples were in their long Bronze Age, they never set permanent foot out of reach of the sea either in Asia Minor or in Greece itself; fifth, that at Troy, if we may use the evidence which exists, the broad-headed type underlies the long-headed type, and the latter only makes itself felt either as a northerly intrusion of the *kurgan*-folk, as in Hissarlik III., or as a temporary annexation of the Troad to a south Ægean sea-power, as in Hissarlik VI.

Thus far we have a situation analogous rather to the activity of

Malays or Vikings, or to the present proceedings of the Japanese or ourselves; the phenomenon of a group of coastal islands influencing, from without, the adjacent mainlands, but not penetrating them or occupying them permanently, except under the occasional leadership of an Agamemnon or an Alexander, whose activity is from beyond the hills, and whose instincts are still pastoral mainly. How these "Mediterraneans" reached the Ægean is a further question. My own impression is that they are, as they themselves believed, indigenous, even if that has eventually to mean *pre-glacial*; analogous to the population of Cyprus or of Sicily, but brought thither possibly by sea; and, if by land, then by ways which postulate either a land-bridge over the Adriatic, or a prolongation westward of the basal plateau of Cyprus.

In any case, the actual distribution of the Ægean long-heads, apart from that of their culture, is no more obstacle to the view here stated of the relationship of the European and Anatolian broad-heads, than is the episode of the Thraco-Phrygian blondes.

The Chairman (Mr. D. G. Hogarth): Mr. Myres has presented us with a problem of very great range and very great complexity. He himself represents a rare combination of the geologist, the palæogeographer, and ethnologist. He deprecates, as those who have read his paper will see, the introduction of the physiological question; but at the same time, if there is any one present who would wish to speak upon that, I am sure he would not object. I always feel that in all these craniological questions there lurks a certain physiological factor of very great importance, but of quite unascertained value—that is to say, the problem as to what conditions bring about change of skull-form, and whether the skulls of a race can alter and the race remain the same. The question has arisen with regard to the present peoples who claim to be Greeks. I think it will probably be better if, to some extent, we keep the different sides of this question apart, and I should therefore propose, first of all, to call on those who can speak to it more particularly upon the geological side, and deal with the question whether the glacial and pre-glacial conditions really render the northern route as impossible as Mr. Myres holds. I should like to know how far they agree with the view of Suess as regards the configuration of the east Mediterranean at a rather later age.

Mr. Arthur Evans: I was not fortunate enough to be present during the first part of Mr. Myres' interesting communication. In any case, it would be difficult to deal with the whole of the questions raised by him. I understand that he wishes to make out that the round-headed "Alpine" race came into Europe by way of Asia Minor, and not, as has been hitherto generally supposed, from Central Asia. In support of this contention he has raised a great water-barrier on the Central Asian side, and thrown a land bridge over the Ægean. It seems to me—not speaking as a geologist, but as one to a certain extent familiar with the subject of Quaternary man—that a good deal of this argument would have been pertinent to the case of the remains of the older Palæolithic population in the European area, and might indeed be applicable in a comparatively late Quaternary period. But we can hardly suppose that, within the limits of any reasonable number of millennia—within the limits, at any rate, of the Neolithic Age—the Ægean was not much as it is at present, and I imagine, in the same way, that the shrinkage of the water-barrier on the side of Russia was of extremely gradual consummation.

We do know, of course, that the remains of human settlements in the Ægean country under its present geographical aspect go back to early Neolithic times, and so far as the evidence goes—so far, at least, as I have been able to follow it—there were at a very early period two main lines of connection with the Ægean area, one of them following the Russian coast of the Black sea, the other going very far north. Particular forms of "idols," which on the Ægean shores belong to the close of the Neolithic period and the earliest age of metal, can be traced by means of intermediate types to the Danubian countries, and again, through the remains in Polish caves, to the Neolithic settlements of the Baltic Amber coast, and even as far north as the interesting settlement on the shore of Lake Ladoga, to which Mr. Myres has referred. And on the other hand, the Neolithic remains of Southern Russia, recently described by Dr. Stern, of Odessa, have brought out very interesting connections between the Neolithic settlements in that region and those of the Danubian basin, and have shown that these extended through the Balkan countries as far as Thessaly. One important point, as it seems to me, is, when do you find this round-headed race making its first appearance in the Alpine regions? So far as I know, the earliest Neolithic remains on that side are all of the dolichocephalic type, and in the Balkan countries, at any rate, the round-headed element begins to appear at a period when metal culture was fairly advanced. I do not deny the possibility of the round-headed Alpine race coming from Asia Minor, but their first appearance in the Alpine regions—which hardly goes back even to the earliest Neolithic stage—certainly seems to date from a time when the Ægean was already in existence. This, indeed, in itself is no bar to Mr. Myres' theory, because there are such obvious facilities of access across the Dardanelles and the Bosphorus, as well as by the island stepping-stones of the Ægean. There is, however, a physiological question that has not been touched.

The theory that has been brought forward by Prof. Arthur Thompson, and experimentally illustrated by him, makes the development of the round-headed type dependent on cranial expansion, due either to the muscular action of the jaw or to increase in cerebral volume. According to this view, it is quite conceivable that there may have been centres of brachicephalic development, radiating from more than one point within a dolichocephalic area, and we need no longer look for distant avenues of immigration to explain the existence of a round-headed race in a given region.

Dr. HADDON: I am very sorry no geographer has spoken, as it is mainly a geological and geographical problem that Mr. Myres has raised. It seems to me that the anthropologists will have to consider very carefully the data supplied to them by geologists and geographers. For a long time I have felt the need of reconstructions of past geographical conditions, and when ethnologists have these they will probably be able to understand the differentiation and migration of races and peoples far better than they could from the material supplied only by their own science. In Asia there seem to be two well-marked groups of brachycephals—the beardless yellow stock, or *Homo mongolicus*, and the bearded white stock, or *Homo alpinus*. I hope Mr. Myres does not propose to introduce into literature, as he did in his discourse, the term "Anatolian" man for the latter group, since the older name is sufficiently explicit, and at any time it can be divided into varieties, such as Cevenole, Dinaric, and Anatolian. It has long been my view that this race originated somewhere on the western plateaus of Asia, and immigrants crossed into Europe, worked their way up the Danube, and entered France, perhaps by the pass of Belfort, in the Neolithic age. I do not at all see how the "diet of masticable fruits" could have materially assisted in inducing brachycephaly, as the people could not have continuously eaten soft food for a long space of time; fruit is ripe

for so short a period, and there must of necessity have been other kinds of food of harder or tougher quality, and why should not these, according to this method of explanation, have elongated their heads? Also I do not quite follow the connection, indicated on one or two of the lantern slides, between certain trees and races of men. I have been greatly interested in this paper of Mr. Myres, and it appears to me that his main conclusions are likely to stand.

Mr. Arthur Evans: I was speaking of the Balkan peninsula. The early appearance of dolichocephaly in the West might possibly be explained by Thompson's theory. My point was in relation to Mr. Myres' theory of trans-Ægean immigration—namely, that, in that case, you ought to find this Alpine type at a very early period in the Balkan regions. Of course, the exploration of the prehistoric remains through a large part of that peninsula is still very imperfect.

Dr. Shrubsall congratulated Mr. Myres on a brilliant and interesting interpretation of the present-day distribution of the Alpine races of mankind in the light of palæography. The chief difficulty seemed to him to be to prove the existence of the broad-headed type at the period under consideration. No remains of the broad-headed type have been found which could be ascribed to an earlier period than the Neolithic, and not to the earlier part even, of that cultural stage; whereas an enormous period of time must have elapsed since the various glacial and interglacial epochs. In the earlier of these epochs there was, even, no quite satisfactory evidence of the very presence of man in the western section of the Eur-Asian continent, so that the development of the special features of *Homo alpinus* at this time in an elevated and isolated Anatolia could be but an ingenious speculation. Another difficulty, on Mr. Myres' hypothesis, which had not been quite cleared up, was to explain the presence of broad-headed man in the Danish islands, the Canaries, and on the Tunisian coast. Lastly, Dr. Shrubsall desired to emphasize the insufficiency of the present data for anything more than an outline hypothesis such as Mr. Myres had propounded; until more was known, any such suggestion was as difficult to controvert as to formulate, but this paper served a most valuable purpose in summarizing the present knowledge of the subject.

The Chairman: Perhaps Mr. Hudleston will say a few words now.

Mr. Hudleston: Of course, it is open to any geologist to make any sort of map he likes, and I am bound to say a great many geologists make maps just in order to suit their own particular views. On the whole, I'd rather not attempt to criticize anything I saw on the screen; although those plans shown by Mr. Myres were most beautiful, yet at the same time I fail to see their connection with the subject, and that being so, I certainly am not competent to discuss it.

Mr. Gray: For the most part, I should be inclined to agree with Mr. Myres. I think in one point, however, he does not take quite the right view: I mean on the question of the influence of environment in changing the physique of a race. I think that anthropologists hitherto have made far too little allowance for the comparatively rapid changes that can be made upon the physique of a race by change of environment. Quite recently there has been a great deal of evidence cropping up which shows that these changes may be very rapid indeed. For instance, some skulls, measured by Dr. Macdonell, which were found in Whitechapel, and pretty certainly date from the time of the plague, belong to a type quite different from any found in the British Isles at the present time. They belong to a race which we can only parallel by going back to Neolithic times. At the present day we cannot find in any region of Great Britain a population corresponding to this Whitechapel population of two to three hundred years ago, and the conclusion that appears to be forced upon us is that the great change of environment produced by

modern industrial conditions has actually changed the type of the race. It has also been found in recent investigations that in large industrial towns the pigmentation of the population is so completely changed that, judging the race from this particular feature, we can only say it is a race entirely different from the average of the whole country, the probability against its being the same race being very high. So that here we have an industrial environment changing a population in a hundred years so completely that anthropologists would be compelled to say that the resulting population was a different race. Now, I think that, in view of these facts, we would have to very seriously consider the possibility of these round-headed types being the result of their environment, and it appears to me to be much more probable that the Cevenole type was really evolved from the surrounding long-headed races than that it was an offshoot of the Dinaric race. It corresponds much more nearly to these long-headed races of the Neolithic type in stature. It seems highly probable, from their present geographical distribution, that broad-headed races are better adapted to mountainous countries than are long-headed races; and if that is so, a Neolithic race inhabiting the European Alps would have plenty of time to develop into a broad-headed race. Mr. Myres seemed to think that it was difficult to change the shape of the skull of a race. But it is quite conceivable that such a change may take place in the course of many generasions under the influence of a moderate selective action always acting in the same direction. The longer-headed members of a group would be eliminated by a suitable environmen', and in the course of time only the broader heads would be left. It is quite possible that by selection the Cevenole group was produced from the previous long-headed Neolithic races. I agree entirely with Mr. Myres that the Dinaric type came from Asia Minor, but I am inclined to think that it is a different type from the Cevenole type, and of quite different origin.

Dr. WRIGHT: I should like, first of all, to congratulate Mr. Myres upon his very interesting paper. I think that by very great ingenuity he has harmonized the facts which we have; my only quarrel would be that the facts are rather too few, and many of them are probably not very correct. I think, too, that the division of the skulls into round-headed skulls and long-headed skulls is altogether too crude. I think it is quite likely many round-headed skulls might be easily developed in a long-headed community. I found, in some skulls I examined in the East Riding of Yorkshire, that one got all intermediate types between extreme dolichocephalic and extreme brachycephalic skulls; but a brachycephalic skull with an index of 82, and a brachycephalic skull from South Germany with an index of 82 might be totally different skulls. I always regard the South German skulls, with that characteristic occipital decline which they have, as very sharply distinguished thereby from other brachycephalic races, and as furnishing really the strongest argument that can be brought forward, that certain round-headed races are racially round-headed, and not produced from long-headed races merely by environment. I was extremely interested, too, in the diagrams which Mr. Myres showed of the vegetation in certain parts of Europe. I think it is very important to bear in mind the vegetation accompanying the different races, and I think one should also consider more the funeral rites which are practised. And then there is another point, and I think Dr. Sturer of Berne is the only man who has taken it into consideration, and that is the domestic animals. I wish Mr. Myres had considered these associations more fully. As regards the origin of this peculiar round-headed people, I imagine them to be of the type of the South Germans of to-day, and not of the type which was found in France and England in Neolithic times, and I think they came comparatively late into Europe, because they are still extremely pure, and I think they came almost certainly from the

East. I think there is no evidence of their coming from Africa. Whether they came north of the Caspian, or whether they came south of the Caspian, I do not think I could offer any opinion of the slightest value whatever. I think Mr. Myres' paper is a very useful one, in that it summarizes the facts and gives us a useful theory upon which to work. I believe, with Prof. Haddon and Mr. Shrubsall, that the geographers and the geologists should come in and give us more facts, and then we might take up the line from them.

The CHAIRMAN: If no one else wishes to say anything, I shall in a moment ask Mr. Myres to reply to the various criticisms brought forward. I can only repeat my regret, and it is evidently the regret of the committee, that we have not been addressed upon the conditions which seem to underlie all these problems—that is to say, particularly, the geological and palæogeographical conditions. The paper deals so exclusively with palæogeography that one feels that one's own personal knowledge of the geography of some parts of this area is of no value whatever. We are really asked to consider this part of the world under conditions totally different from those which obtain at present. But, so far as I know the geography of Asia Minor and of the Balkan lands, Mr. Myres has stated the modern conditions where he brings them in, with very great accuracy. There are one or two minor points in his paper which I should like a little more information about. One of those is with regard to a remark he makes at the end of the paper about the prevalence of the long-headed *Homo* Mediterraneus in the Ægean islands up to quite the end of the Bronze Age. He mentions it as being absolutely exclusive. Of course he would admit that the data at our disposal are very few. There has been a certain amount of anthropometric investigation in Crete, but so far as I know not more than about 70 skulls have been examined, and those, as it happens, belong to one period of the Ægean civilization, and that an early one. We have practically no information about the latter periods, and it is just in one of those that a rather curious contradiction seems to be suggested by the type which is represented upon one of the Knossian frescoes which Mr. Arthur Evans first discovered, the fresco since known as the "cupbearer," which reminded him of the Albanian type; that is to say, we have a broad-headed type represented. That possibly may imply the entrance of a new race such as there is some other evidence to show may have come in about that period. At any rate, it seems to me to impair the general statement which Mr. Myres has made in his paper, that the long-headed race prevailed exclusively in the Ægean lands down to the end of the Bronze Age. Then again, though perhaps it might take us too far afield, I always feel I want my doubts about some palæoliths removed; that is to say, how far the presence of man can be assumed simply from these so-called stone weapons. I noticed, in one sketch-map which Mr. Myres put upon the screen, that he indicated these palæolithic remains extending in a kind of crescent round as far as Egypt. I believe there is more doubt about Egyptian palæoliths than perhaps about any others. There you have a country where peculiarly dry conditions have prevailed for many centuries, conditions in which sand can exercise its greatest power, and these supposed flint implements could have been produced by natural action, and not human action. However, Mr. Myres did not rest any part of his argument upon the distribution of palæolithic remains. With regard to what Dr. Haddon said about the introduction of the name "Anatolian man," I would join with him in deprecating the bringing in of such a name. I think it would be peculiarly inappropriate, because "Anatolian" is not only a modern name, but also describes purely modern conditions; that is to say, it is applied to the eastern part of an area which, according to the theory of Suess, had no distinct existence in geological time; therefore we had better not have a peculiar type of man introduced

as "Anatolian man." I am rather glad to see that those authorities who have spoken with peculiar knowledge of craniology all seem to echo my doubts about the physical factor in craniological questions. They all seem to imply that there is little reason to suppose broad-heads need always have come from a common origin, and that they may have developed quite independently. And I must say that I feel a little doubt about the great superiority of this enlarged south-eastern Balkan area over the Balkan area as it is at present, for the development of a special type of man, and I feel still greater doubt about the conditions of isolation which Mr. Myres seems to postulate as necessary for the evolution of a distinct type. Then, again, there is the difficulty which has been brought forward about the presence of small patches of broad-headed men at a considerable distance from any centre of broad-heads, and cut off from them at present by very considerable geographical boundaries. But the time is getting late, and I think there are a great many things about which Mr. Myres has been asked, and if no one else wishes to say anything I will ask Mr. Myres to reply.

Mr. Myres: No one could be more sorry than I am that we have not been fortunate enough to draw the geographers and the geologists. It is precisely because it seemed to me worth while to do even very imperfectly what Dr. Haddon insisted on the importance of—re-construct the palæogeography of this region—that I ventured to submit this paper to the committee at all. One or two points of geology have, however, been raised. Mr. Shrubsall, in particular, raised points which I admit were very natural interpretations of the maps which I put on the screen. I used a map labelled "interglacial conditions" to illustrate also a point in post-glacial times. I ought to have explained—and if I had not been cutting things down I should have explained—that upheaval at one period of comparatively mild climate does not, of course, mean that upheaval occurred in a similar way at the next subsequent period of mild climate. I ought really to have produced a map which would show the retreat of the ice-sheet when it was retreating finally, and not have economized by showing over again a map which showed the retreat of the ice-sheet under what seem to be regarded, at all events by some geographers, as having been conditions of upheaval in the north-west.

There is a further point. If I understand the geological evidence, upheaval in the north-west does not necessarily mean upheaval in the south-east also. One of the things, upon which apparently geological speculators seem to be fairly agreed, is that one gets evidence of differential upheaval. And, in particular, in regard to the Ice Age, one of the things that seems to have happened is that the whole of the sub-structures of what is now Europe swung to a certain extent upon an axis: sometimes that axis is sufficiently central to cause an upheaval of the south-east when there is a depression of the north-west; sometimes the whole thing moved more like the lid of a box, and then you have only differential upheavals. One's own experiences in the Ægean teach one sufficiently well the extent to which, in a small area like that, very marked swings occur. Take the island of Crete. In the west, you have an upheaval of 80 feet since classical times, and in the east you have a depression of 30 feet.

In regard to the question of environment and physique, I do not think Mr. Gray took account, in his criticism, of quite all the cases that one has to deal with. When you have got ancient and modern stages of the population of an area, in some cases you find it is perfectly true that an absolute change of type has taken place in time without any obvious change of population, historically recorded or evidenced by changes of culture and so forth. But it seems to me that that is only one of three groups of cases. For instance, in the Ægean you can trace definitely the intrusion of fresh people out of an adjacent area, and *pari passu* with that a

gradual change of the skull form. That is to say, it is roughly in proportion to the exposure to incursions which the Ægean had undergone, that you find the Greek physical type altering. There you seem to have a case of what one was taught in one's youth was "concomitant variation." Then take the case of Sicily and Italy; there you have a population which has undergone all sorts of conditions; you have periods of great prosperity, and periods of starvation; the country has such an enormous seaboard, it is liable to have all sorts of things happen to it. But in spite of that, there is practically no difference at all in the population of South Italy and Sicily since Neolithic times onward. Here you have all sorts of conditions apparently changing, and the physical type simply sticking where it was. So that I am not sure that the case is by any means made out at present for anything like habitual variation of type. No doubt in this, as in other respects, some types of mankind are much more stable than others; and probably where a type has been once mixed, a certain swing of the pendulum goes on while it adjusts itself.

With regard to the particular piece of evidence upon which Mr. Gray laid most stress, one has to remember modern conditions are modern, and it will be a very dangerous thing to argue, because in the east of London artificial stress has produced certain effects in a couple of centuries, that even in two thousand years comparatively small results would be effected when you are dealing with mankind in the state of nature. That meets also a point Dr. Haddon raised, as to the hardness and softness of skulls. I doubt whether Neolithic skulls were much softer than modern skulls; I think they would be harder; but the period of time is infinitely longer.

There was another point with regard to food and trees. I am bound to say, in passing, that the evidence in regard to the animals is to my mind so very difficult that I left them out. I have been into the case of animals as far as I have had the opportunity, but the illustrations of "spread" in a particular direction—I confess I am looking for "spread"—the particular illustrations all happened to come from the plant world. Besides which, the animal is much more migratory than the plant, especially in association with man. Man can take his animals with him; the plants by no means follow so well; they are, therefore, better test cases of the lines of least resistance, climatic and geographical. I, perhaps, ought to explain more clearly than I did before, that the reason why I laid stress upon the chestnut in particular is because it still remains, over the area where it will grow, a very considerable article of food, especially among the least civilized classes. One sees this very markedly in Crete, and all round the fringe of the Ægean; one sees it again in north Italy, and pretty well wherever the chestnut has gone. The case of the chestnut is the clearest, but in the case of stone-fruit particularly there does seem to have been concomitant intrusion of certain edible fruits along with the arrival of broad-headed men. Of course, our evidence with regard to that is from the things found in settlements. We cannot tell that they had them for food or simply for toys, but it looks as though the way they got at the peach-stone was that they ate the peach.

One point more Mr. Shrubsall raised with regard to the route of influence from north-west into Russia. One has to draw distinctions between a route of intercourse and a route of migration, and I am not at present satisfied that we have any evidence of a route of migration—of bodily transference of masses of people—from the Ægean north-westward so as to complete the circle, which he mentions, of broad-headed man. Where one can trace broad-headed man in the area between (say) the mouth of the Danube and the Ægean islands, he has the appearance of being intrusive and comparatively recent, and not earlier than Neolithic, at either end, so far as one can interpret the evidence at present.

I am afraid I did not make myself quite clear about the question of the long-headed people in the Balkans. I had to mention them, and the thing would have borne considerable expansion; but the difficulty which Dr. Evans feels, and we all feel, is this: How is it that you have a well-marked and very persistent patch—we do not know that it is more than a patch—of long-headed people among the Bosnian tombs at a period so very much later than that at which we have well-marked broad-headed people so much further west? Either the broad-headed people came by way of the north route out of Asia, or they came by way of the south route. I hope that I have satisfied others besides myself that the north route was closed. If they came by the south route, how is it that they have left this patch, or that this patch of broad-headed peoples in Balkan lands has survived? My suggestion for dealing with that difficulty is to suppose that the tomb-type is of significance; and that, thanks to their tomb-type, one is justified provisionally in regarding these Bosnian long-heads as an intrusion (of a kind which has frequently happened since) of pastoral people out of the steppes into the Balkan peninsula who have pushed considerably far afield into an area where broad-headed man did not follow, and where possibly he never had been. I suggest that the reason is, that (so far as we know) the geology and geography of that area are such as to make it neither forest nor lake-land.

Dr. Shrubsall's point about the Guanches is explained, I think, if one interprets Deniker's "Atlantic-Littoral" type as the result of the intrusion of "Dinaric" tall short-headed folk among a "Mediterranean" population, long-headed and short. Thus interpreted, the distribution of the "Atlantic-Littoral" type reveals itself as a series of stepping-stones between the south-western fringe of "Dinaric" man and the Guanche and other short-headed outliers in north-west Africa. That is why I have included the "Atlantic-Littoral" people in my map-analysis of Deniker's conclusions: it is the south-western counterpart of his "Eastern" race in central Russia, and his Russian patches of "Cevenoles" are the analogue of the Guanches.

Dr. Wright's suggestion as to the comparative study of funeral rites leads to very instructive results already; but one of the points still in suspense is, how far funeral rites can be regarded as really deep-seated characters of human groups. One can learn to bury one's dead a fresh way; one cannot learn a fresh shape for one's head. In the case of the southern analogues of the *Kurgans*, even, I only venture to adduce them in this argument because I think there is sufficient evidence on the physical side to justify the assumption of early long-headed intrusion southwards from the *Kurgan* area proper.

A FIFTH JOURNEY IN PERSIA.*

By Major P. MOLESWORTH SYKES, C.M.G.

After leaving Rizáb we rose steadily to the watershed, which was almost level for about 2 miles. We then descended close under a red and yellow hill, where the steep ravine was almost too much for the labouring team; but at last that obstacle too was left behind, and, finally, after a march of 37 miles, Sághand was reached. Late at night

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* Read at the Royal Geographical Society, June 18, 1906. Map, p. 429. Continued from p. 453.

one or two beggars who had not been worth "trussing" arrived, from whom we learned the fate of our fellow-travellers, and were amused to hear that we had been cursed freely by the bandits for interfering with the exercise of their profession on the advanced caravan, which we had, quite unwittingly, protected by our presence.

The crux of this section of the journey was a 33-mile waterless stage from Robat-i-Khán to Chashma-i-Shuturán, with a belt of sandhills which commenced at the twenty-second mile. To give our horses every chance, water and forage were left by the advanced camp at the waterless caravanserai of Robát-i-Sirka, situated close to two red-brick obelisks, said—and probably with truth—to date from Safavi times. There, after five hours' rest, the carriage, drawn by four horses abreast, started to cross the dreaded sandhills, which rise to a considerable height and form a fitting boundary between the deserts of Yezd and Tabas. Thanks to the precautions taken, and to the fact that the carriage was almost empty, the horses were just able to master the steep gradients, and at sunset, wearily enough but without a breakdown, the whole party had reached camp, accompanied by two travellers whom we had rescued, inarticulate from thirst, in the middle of these shifting sands, which during a gale must indeed be dangerous. Beyond Robat-i-Khán, the carriage, as apart from the horses, underwent its most severe trial. The route was quite impracticable, as being too narrow for wheels, and the river-bed constituted the only possible route; but this in parts was so narrow, owing to the huge boulders, that it is marvellous how the carriage passed. In places rushes were made, in which we all aided; but elsewhere the horses were driven up until the wheels touched the obstacles, when judicious slewing round of the back portion of the carriage had the desired effect. Throughout one admired the resource shown by the coachman, who was an Azerbaiján Turk, and differed as much from the voluble Persian as an Englishman does from an inhabitant of Tarascon.

Eleven stages, or 220 miles, were at last accomplished, and our interest was excited to the full when we looked down upon Tabas, one of the most remote towns of Irán. To appreciate the oasis, it should be approached, as on this occasion, after many days of wearisome and monotonous travel across the Lut, during which no greenery had been seen, and the daily provision of water and forage had ever been the prevailing question. The surroundings of the town, too, are arid, the terrible desert stretching to the south for hundreds of miles, its white glistening surface being broken in the far distance by the Naiband range, which I had explored twelve years previously. With our eyes filled to repletion with this blighting, palsying waste, the sight of Tabas was indeed refreshing, and when, skirting the town wall, we drove for more than a mile up an avenue bordered on both sides by mulberries, elms, willows, and palms, we revelled in this wealth of fresh greenery, which

was accentuated by the murmur of running water and the smell of beans in flower, surely one of the most delightful of odours.

Tabas, known as "the Gate of Khorasán," was termed Tabas-at-Tamr, or "Tabas of the Date Palm," by the Arab geographers, to distinguish it from Tabas-al-Unnab, or "Tabas of the Jujube Tree," which I described in a former journey * as being situated some three stages to the east of Birjand, and which is now known as Tabas Sunni-khána. The date of its foundation is unknown, but it is connected by place-names with Parthian times. This dynasty is termed Ashkáni by the Persians, a word represented by the classical Arsaces, which was the title of the royal family. I may incidentally remark that the Chinese envoys of the second century B.C., who were the first to open up communications between the Far and Middle East, refer to the King of An-Sih, which fact is of considerable interest.† In the Tabas district is Deh Ashk, and also Darra Ashkán, which names corroborate the above theory. Tabas was conquered by the Caliph Osman, as were also Káin and Kuhistán, in A.H. 31 (651). Later on it became a centre of the famous Ismaili sect, whose extraordinary tenets are responsible for the word "assassin," and for the true story of the "Old Man of the Mountains." Marco Polo did not, I think, visit Tabas; but I have recently dealt with this question in the *Geographical Journal*.‡ Here it suffices to state that the great traveller describes his route as far as Kubanán, some five stages to the north of Kermán. Thence I originally thought that he crossed the Lut to Tabas, but my inquiries have tended to prove that Ser Marco, in all probability, travelled *viâ* Naiband to Tun by a route which keeps to the east of Tabas. Tabas, in the eleventh century, became known as Tabas Gílaki, after a chief who conquered it, whereas Tabas to the east of Birjand was termed Tabas Masinán. But I must not allow myself to be led away into an historical dissertation, and will pass on to the eighteenth century A.D., when Nádir Sháh, in return for services rendered when lost in the Lut, conferred the district on Ali Morád Khán, an Arab of the Zangui tribe, which is connected with the Khuzái tribe, to which the amirs of Káin belong. The same family still governs the district, although their position is far different from that held by them after Nádir Sháh's death, when the ruling chief made a bid for the throne of Persia.

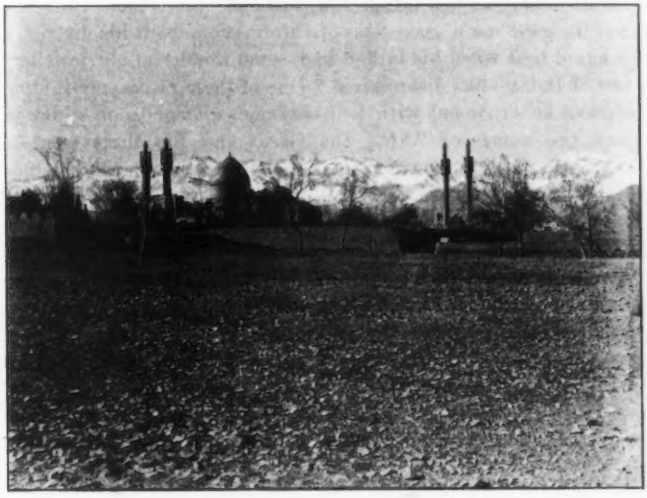
Before describing the little town, I propose to make a short reference to the district. Tabas and Tun, the division to the east, together with Gunabád to the north-east, unite to form the governorship, Tabas being the poorest of the three divisions, the latter two of which I have

* *Vide Geographical Journal* for February, 1902.

† *Vide* 'Chinese Knowledge of Early Persia,' by E. H. Parker. *Asiatic Quarterly*, January, 1903.

‡ *Vide Geographical Journal*, vol. 26 (1905), p. 462.

previously described. Situated on the edge of the Lut, and growing but scanty crops, which do not provide more than six months' food for its population, Tabas depends mainly on its date palms and orange groves, the produce of which is highly prized in upland Khorasán. As is general in Persia, the population is divided into dwellers in villages and nomads. The latter are all of Arab extraction, and possess enormous flocks of sheep and camels.* The town of Tabas, which is situated at an altitude of about 2000 feet, is walled, and contains various bazaars. But the chief, if not the only, object of interest is a fine column which rises to a height of some 200 feet, and is known as the Minár Kabír, or the "Great Minaret." It is constructed of brick set in various patterns,



THE MÁHUN SHRINE.

and has two bands of a Kufic inscription running round it: apparently it dates from Seljuk times. The origin of these columns has been much discussed by travellers in Persia, but as they all possess a staircase, it is, I think, extremely probable that they served as watch-towers primarily, and also as beacons. In the wide plains of Persia, where surprises were the one thing to be especially guarded against, the utility of the watch-towers is evident. Modern Tabas, owing to the cessation of the Turkoman and Baluch forays, has partly deserted the cramped bazaars and spread east on both sides of the avenue

* The nomads are: Chubdári, 200 families; Khanjari, 250 families; Arab, 200 families. In the winter they graze near Tabas, and in the salt country to the north. In the summer they move to the hills in the Tun and Gunabad districts.

referred to above, where the population, estimated at 8000, occupies gardens. Two miles to the west is the shrine of Musab ibn Jafar, who is locally known as *Shahzáda* Sultán Husein. This was, I believe, the site of a still more ancient Tabas, it being comparatively easy to change the position of a town situated in a plain which is served by irrigation streams. The dome of this shrine is said to have been built by *Mir* Ali Shir Khán, Sheibáni in A.H. 950. To conclude this brief sketch, Tun and Tabas are regarded as the least delectable of the districts of Khorasán, and "Go to Tun and Tabas" is by no means a polite remark.

The evening of our arrival I was welcomed by the Imád-ul-Mulk, who is not only a lineal descendant of the old chiefs of Tabas, but, on the distaff side, can boast that the blood of Nádir Sháh runs in his veins. He gave me a good deal of information about his district, and I also heard that when his father died, some wonderful old jewellery—the loot of Delhi—had disappeared. One of these pieces, my informant stated, was an ornament with four enormous diamonds, on which were incribed the names of Akbar the Great and his three successors. Tabas struck me as very much out of the world; but there is now a weekly post with Meshed, and I am agitating for it to be continued to Yezd, as in Eastern and Central Persia there is no south-to-north postal service, so deadly a barrier is the Lut.

We had now accomplished about two-thirds of our long journey, and as we were not only marching north-east, but also were approaching districts less low-lying than Tabas, we started, after two days' rest, with the feeling that the worst had been left behind. We crossed the low range bounding the plain of Tabas to the north, and descended into a district of great *Kavir*, by the side of which the Tabas nomads were grazing flocks of sheep much larger than any we had seen in South-east Persia. Indeed, everything was by comparison green and fertile, although only practised eyes would perhaps have noticed the great difference. At Yunsi we joined the direct Kermán-Meshed route. Lying in the midst of a level salt plain and on the banks of a salt *kál*, or river, this village is one of the most depressing places in Persia; it is referred to by Sir F. Goldsmid* in connection with a legend that the prophet Jonah was thrown up at this spot, and took refuge under a gourd. A few stages later we traversed the last of the salt plains and reached the fertile district of Mahavalát, which is the centre of a thriving silk industry, and is famous for its melons. It lies on the skirt of the high central range of Khorasán, and from it as far as Turbat-i-Heideri, which was reached on May 3, there was a steady rise throughout. The district of Turbat-i-Heideri was originally known as Záva, of which the chief town was termed Bishak. To-day

* *Vide* 'Eastern Persia,' p. 250.

Záva is the name of a flourishing village one stage to the east of the town of Turbat-i-Heideri, but has ceased to give its name to the district. Rukhh, by which name the northern portion of the district was known in mediæval times, is also no longer used. The nomenclature of the capital town of the district is derived from Heider, who was the founder of the sect bearing his name. This holy personage, in the seventh (thirteenth) century, became famous for his endurance, inasmuch as during the summer he walked about in fire and dressed in felt, whereas in midwinter he lived in the snow. Heider, who is generally better known by the title of Kutb-u-Dín, or "Pole of the Religion," is buried in a dome built over his *turbat*, or tomb, and this is the origin of the name. Less than a century ago, Ishak Khán, a Karái chief, seized the district, and for many years the town was termed Turbat-i-Isá-Khan. To-day, however, the original name is almost entirely used, and Ishak is forgotten. At Turbat-i-Heideri I joined the route followed by me in 1893. At that date I put up at a caravanserai, but on the present occasion we were welcomed to a comfortable consulate, and thoroughly enjoyed the hospitality of Captain J. Watson. The little town has grown considerably of late years. It possesses remarkable nodality, as roads from Meshed, Herát, Seistán, Kermán, Yezd, and Turshiz all unite in the little walled bazaar, which is estimated to possess 8000 inhabitants, and is the centre of the silk and Baluch* carpet trade. To resume, the last section of rather less than 90 miles brought us to Meshed of the golden dome, where our march of over 700 miles, accomplished at a rate slightly exceeding 16½ miles per diem, was brought to a successful termination.

V.

For some months after reaching Meshed the press of official work prevented me from examining the surrounding country; but late in the summer I made a flying trip to the district of Kuhpaia to the west, across which runs the direct route to Nishapur. This district is extremely historical, and among other claims to interest is the fact that in it is situated one of the original fire temples founded by Zoroaster, which has never been identified. Of this, one of the most important sites in Khorasán, I have some information, and I hope, during the course of the next few years, to prove my information correct, but on the present occasion there was not sufficient time at my disposal. To resume, in the first place we drove to Gulistán, at the entrance of the Nishapur range. This village is composed of houses running to three storeys, with windows cut in the main wall, and

* There are 1700 families of Baluchis in the Turbat-i-Heideri district. So far as they themselves can tell, they have come north from the confines of Baluchistán during the last century.

presents a most curious and picturesque aspect. Below runs a river, across which is constructed one of the very fine old dams which abound in Khorasán. The legend runs that its builder buried enough gold in its foundations to reconstruct the entire work should a flood sweep it away. Passing Gulistán, we continued our journey up the valley to Turgabeh, a corruption of Turuk Oba, or "the Settlement of the Turks," where we found our horses awaiting our arrival. Thence the river-bed was struck, and our senses were charmed by a valley with glades, trees, and greenery, the like of which I have never seen on the Irán plateau; and yet all was northern in character, from the elder bush to the poplar, and from the sweet-savoured thyme to the wild rose. In short, one felt in surroundings such as would befit the "Midsummer Night's Dream." Six miles above Turgabeh is the large village of Jághark,* which is a typical hill village. Lining both sides of the precipitous valley, the houses, constructed of the rounded stones from the river-bed, rise to a considerable height, and are remarkable for their overhanging eaves, which are carved and painted, and for their rough windows of wooden latticework. The lower storey contained the farmyard, and the dwelling-rooms were perched above. Trees were everywhere, and often formed part of the wall, and might even be seen growing up through a roof. The setting of these truly charming villages is enhanced by little cascades, which tumble down the mountain-side and add to the volume of the murmuring brook. But yet the name of Jághark is ominous, and signifies "the Place of Drowning," and every now and then a storm in the hills produces a flood with such disastrous rapidity that on one occasion an entire regiment was drowned in the narrow gorge. Jághark, too, possesses a curious legend, in which reference is made to a ship floating on its waters. These legends are also crystallized in place-names, such as Langar,† signifying an anchorage, and Yunsi, which commemorates the prophet Jonah, and one is tempted to believe that they are the echo of a far-off rumour of the days when there was an inland sea in Persia. Passing through the busy bazaar, and then the tea-shops, consisting of fantastically shaped platforms built on piles over the stream, the ascent became steeper, the atmosphere grew fresher, and the valley narrower, until our guide led us by a tortuous track up through delightful orchards to a spur where the greenery suddenly terminates and gives place to the naked hillside covered with slate *débris*. Below this a little side valley ran up to a stream, and so much impressed was I with its charm and remoteness that I decided to convert it into a hill station for Meshed; and, indeed, no more ideal spot is conceivable, as a cottage perched on this spur overlooks a bend of the valley which forms a sea of greenery, and yet is raised

* *Vide* Yate's 'Khorasan and Sistan,' pp. 348 *et seq.*

† Langar is situated one stage to the north-west of Turbat-i-Sheikh-Jám.

above the unwholesome damp of the valley, and far from the still more baneful mosquito. We spent the night in the champagne air of the hillside, and early dawn saw us on the road bound for the Dar Rud pass. We crossed and recrossed the brook repeatedly and, as we ascended, the sides of the valley became precipitous, and the dense growth of plane and poplar was succeeded by scanty willows. These too in time ceased, and we thenceforward rode up a stony, forbidding valley to a point where the valley bifurcates at a small stone caravanserai. The climb up the pass was long, but easy, and some four hours after leaving camp, we reached the summit at an altitude of 9400 feet, or 4000 feet above our camp, and more than 6000 feet above Meshed. To the south the range was narrower, probably owing to the fact that

KAVIR, OR SALT GROUND IN THE LUT.

the snow melts sooner on the southern slope and cuts a deeper channel, whereas on the northern slope the snow lingers late into the year. We were looking on to the plain of famous Nishapur, but a haze brooded over everything, and nothing was visible in that direction Looking back in the teeth of a furious gale, and following down the wide fertile valley of the Kashaf Rud,* the dark green of the gardens surrounding Meshed was easily discernible. But the golden dome remained invisible, until, gazing intently, a fitful flash as if of summer lightning flickered and again vanished, and it was thus that the glory of the Persian religious world was revealed to us from afar. The summit of the range consisted of rolling downs, with a few elevated mountains.

* Kashaf signifies "a tortoise."

One of these to the north-west is termed the Luk Tarsa, or "the Fearful Camel." Behind it was Pishána Fil, or "the Elephant's Forehead." The return down the valley to our camp and thence back to our home on the following day was speedily accomplished, and we agreed that Meshed compared more than favourably with Kermán in regard to its summer retreats, which are within an easy ride of the city, and would be an acquisition to any capital in the world.

In the autumn of 1905, the British minister, Sir Arthur Hardinge, traversed Khorasán on his way to England *viâ* Trans Caspia and, after the attractions of Meshed had been exhausted, it was arranged that a visit should be paid to the most famous fort of Central Asia, which is known as Kalát-i-Nádiri. Leaving the capital of Khorasán early in September, we marched due north to Rizván, situated on the skirts of the northern mountain barrier of Irán, which has already been referred to in this paper. The actual range is entered by a rocky gorge, which forms a fitting portal to rock scenery of stern and awesome grandeur certainly unsurpassed in any part of Persia I have visited. The track ran up the river-bed, which was subsequently quitted, and rose across some low hills to the upland village of Kardeh. From this village we started off betimes, escorted by some horsemen who belonged to the Chulái, a Turkish tribe, settled in these parts by Tamerlane. They apparently talked Turkish among themselves, but understood Persian. Their dress closely resembled that of the Turkoman, except that their sheepskin bonnet was cut lower. They struck us as fine, hardy men of a manlier type than the Persians. The whole district is called Chulái Khána, the Kara Dagh constituting its northern boundary. Nine miles above Kardeh we halted to photograph and examine an inscription which the late Mr. Ney Elias had had copied. It is situated on the left bank of and well above the river, and consists of ten lines, which measure 5 feet 6 inches by 3 feet 2 inches. The inscription, which is beautifully incised and quite legible, is to the effect that in A.H. 915 Abul Fath Mohamed Sheibáni defeated a Persian force in this neighbourhood.* Several photographs were taken, most of which were successful, and we continued the ascent past a completely round white cliff. It is known as Panj Mana, or "the Five Stones," † and is connected with a far-fetched story of a courtier who apparently offered to put the weight with it. Eighteen miles from Kardeh we quitted the main valley and scrambled up the very steep and boulder-strewn narrow gorge known as the Zo-Pir-i-Zan, or "Valley of the Old Woman." However, the gorge in question was not so bad as the one

* Mohamed Sheibáni was almost the last warrior of the house of Chengiz, and the founder of the Sheibáni dynasty and of the Uzbeg kingdom, which lasted until Khiva, Khokand, and Bokhára fell before the onslaught of Russia some thirty-five years ago.

† A *man* is of various weights, but the Tabriz man, which is most generally used, weighs about 6½ lbs.

bearing a similar name in South Persia, and, above it, we emerged on to rolling hills, traversing one of the two great parallel spurs into which the Hazár Masjid range divides, the second being known as the Kara Dagh, or "Black Mountain." The descent across this second range was extremely trying, and its name of Diwa Boíni, or "the Camel's Neck,"* struck us as most appropriate. At last we reached Várdeh, only to find that the advanced camp was still trying to find a way round. However, we ultimately obtained all that was necessary, and settled down for the night, after accomplishing a particularly trying march. The following day we crossed yet another range, and descended a valley with superb rock scenery, great ribs of slate rising precipitously from the sullen gorge. A good photo of the rocks in the Darband-i-Gaur, or "the Fortified Gate of the Infidel," as it is termed, was secured, and the journey was resumed down the valley, which gradually opened out, but in front all further progress appeared to be barred by mile upon mile of sheer precipice. This is the southern wall of the Titanic fort of Kalát-i-Nádiri, which runs in an almost unbroken line as far as the eye can reach. Before the visit of Sir Arthur Hardinge to Khorasán, the Governor General had promised to arrange for my entry into this somewhat jealously guarded stronghold, in which no previous consul general had been permitted to set foot, although Sir Charles MacGregor and Colonel A. C. Yate were admitted to it thirty and twenty years ago, and there is no reason for debarring a sight of its wonders to travellers. At the same time, on nearing the historical fortress, I felt considerable anxiety as to whether the governor would obey the *Asaf-u-Dola's* orders, as he is appointed direct from Tehrán, and is thus more or less independent of the Governor General of Khorasán. It was, consequently, with much relief that I sighted a reception party headed by the governor's son, under whose guidance the minister was escorted to the Argawán Shah *darband*, outside which our camp was pitched.

I now propose to give a brief description of the famous fortress which we were to enter on the morrow. Its shape exactly resembles the profile of a wild boar, its general direction running west-north-west. The southern wall, already referred to, is the most uniform in appearance, and some 15 miles in length. It is broken at the Darband-i-Argawán Sháh, which represents the boar's mouth, and again, at the south-east extremity, there is a second entrance known as the Kushtani *darband*. This latter is situated on a long narrow spur in which the fortress terminates to the south-east, thus continuing the extraordinary resemblance referred to above. The whole of this stupendous wall rises almost sheer to an altitude of some 1500 feet. Of this perhaps one-half or two-thirds of the distance is climbable, but the crest is

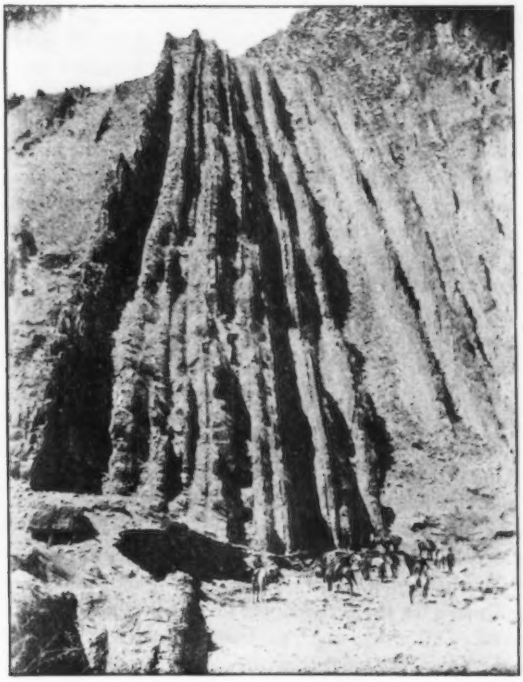
* The names in this district are mostly Turkish.

composed of a black rock, possibly basalt, resembling in shape a wedge, which is so narrow on its inaccessible summit that it would be almost impossible to walk along it. Continuing in a west-north-westerly direction from the *darband* of Argawán Shah, "the snout" of the fortress is most clearly defined, and the boar's "eye" is the Dehchi entrance on the north. This side rises at least 2000 feet above the valley, but it struck me as less inaccessible. At the same time, it is only fair to mention that I inspected it from the crest only. The boar's "back" is broken by the Deh Nafta darband, and through it the river, which enters Kalát-i-Nádiri by the Argawán Shah *darband*, flows down to water the fertile oasis of Doshakh, the ancient Abivard. It is known as the Nafta river.

On the east side there is the fifth *darband* of Chubbast, and, as stated above, the fortress terminates in a narrow spur to the east. So much for the circumference, which is perhaps 60 miles in perimeter. I now turn to the interior. The life of Kalát centres in the narrow valley, some 12 miles in length, which runs approximately from west to east between the Argawán Shah and Nafta *darband*. Almost throughout there is a narrow strip of cultivation which supports perhaps one thousand inhabitants. Elsewhere, there are three or four small villages dependent on rain crops, the inhabitants of which bring the total up to two thousand. What particularly struck me was the hilly nature of the interior. Hills are everywhere, chief among them being the Kuh-i-Bába-Kumeili, which rises to over 6000 feet, and more or less fills up the south-east corner. Elsewhere, too, once the narrow valley is left, the rough track winds across a maze of low hills, so much so that internal communications are extraordinarily difficult. The altitude of the main valley is about 3000 feet, and, partly owing to its shut-in condition, it is extremely hot in summer. The main water-supply is drawn from the river, but there are a few small springs of good water. The climate is unhealthy, and the mosquito so active that every one sleeps under curtains, the only corner of Persia where I have noted this custom.

The history of Kalát, which I have collected from various Persian chronicles, is, as might be expected, of considerable interest. In Firdausi's great epic, known as the "Sháh Náma," the district is referred to as Kalát and Charam, the latter being the name of an important village, still existing some 6 miles to the west of Kalát. In it a grim tragedy was enacted on the occasion of the invasion of Turán or Central Asia by the forces of Kei Khusru, a semi-historical monarch of Persia. It was inhabited by his half-brother Farud, who was independent, and the Shah enjoined upon Tus, his commander-in-chief, the necessity of avoiding the district. However, it was found that the alternative routes led through deserts, and the Persian army perforce entered the gorges to the south of Kalát. Farud, hearing of the approach of a mighty host, took up his position on a lofty crag and

watched the army defile below him. He was accosted by the hero Bahrám, who, on being shown the mole on Farud's arm, which proved him to be of Keiánian stock, reported to Tus that it was the Shah's brother. Tus, however, cherished sinister designs, and, wishing to sack Charam, refused to acknowledge the identity of Farud, who was attacked. After slaying various Persian champions in Homeric style, the hero retreated to the fort, whence he shortly afterwards sallied forth and gave battle until the whole of his force was exterminated and



SLATE FORMATION IN THE DARBAND-I-GIAOUR.

he himself was mortally wounded. Returning to his fastness with difficulty, he was received by his mother, who fired the treasury and hamstrung the horses. The women committed suicide by throwing themselves from the top of the fortress, and finally Farud and his mother killed themselves. Tus burst in the gate, to find nothing living inside, but merely a mass of ashes on which to satiate his thirst for plunder. From the above it does not appear that Kalát was renowned for its natural strength in the tenth century of our era, when Firdausi

lived, but in A.H. 682 (1283) Arghun, termed Argawán by the Persians, took refuge in the fastness after suffering defeat at the hands of his uncle, Sultán Ahmad. He was besieged, but without success, and, using the impregnability of Kalát as a lever, he opened negotiations with the nobles of Tabriz, and finally won the throne of Persia. This constitutes the first historical siege of Kalát.

But it was not until blood-drinking Tamerlane strode across the stage of Asia that Kalát won its imperishable fame and the title of the greatest fastness of the Middle East. The "Lord of the Conjuncture of the Planets," as he is termed, found Kalát in the possession of a certain Ali Beg, and attempted its capture by surprise, but in this he failed, although he seized many flocks of camels and sheep. He then formally invested what is now known as the Nafta *darband* in person, his amirs attacking the other entrances. Some Badakshání hillmen discovered a track, up which they climbed the cliff, and matters looked black for the defenders; but Ali Beg proposed a meeting to arrange the terms of surrender, and took advantage of its being granted to break down this track. Fourteen general assaults were then delivered, but were repulsed without difficulty, and the world conqueror was forced to retire defeated. Two years later, *Amir* Sheikh Ali, a nephew of Tamerlane, escaladed the natural barriers, but, once there, found himself caught, and when his arrows were expended was forced to surrender. Shortly afterwards plague broke out, and wrought such havoc among the defenders, that Ali Beg surrendered and was put to death.

Kalát apparently does not again figure large in the history of Khorasán until the star of Nádir Sháh, the last great Persian conqueror, rose on the murky horizon, and in a few years restored to Persia her dignity and prestige, which the Afghan invasion had for a time shattered. Nádir Sháh was a glorified robber who was born in the neighbouring district of Darra Gaz, and throughout his career cherished a strong affection for the fortress which was thenceforward to be known by his name. After his glorious triumphs in Afghanistán, in India, in Bokhara, and in Khiva, the dread Afshár repaired to Kalát in A.D. 1740, and began its fortification by building the works which we saw. He cherished a dream that one day he would retire to spend his closing years in this safe retreat, and it was here that he stored the untold millions of India, with the famous diamond, the Daria-i-Nur, or "Sea of Light." His family, too, was sent to live in the same fastness. Fate, however, never permitted the realization of these idle dreams, and Nádir Sháh was assassinated in A.D. 1747, and fell, cursed for his cruelties by the whole nation. A nephew, Ali Kuli *Khán*, was elected his successor, and his first act was to send a band of Bakhtiári horsemen to extirpate the tyrant's brood and seize the treasure at Kalát. The carelessness of the garrison, a member of which

had neglected to pull up the ladder, by which means alone there was communication with the outer world, made everything easy, and in a few hours every male descendant of the conqueror of India was put to the sword, and the treasury was looted. One scion of the house, Sháh Rukh, a grandson of Nádir Sháh and a mere boy, was alone spared, in case the nobles clamoured for a member of the royal house, and with this grim tragedy the description of Kalát-i-Nádiri may fitly be brought to a close, just as grim tragedy ushered it on to the stage of history.

I now return to our journey. We quitted camp at dawn on the following morning, and were soon riding between two precipitous cliffs,

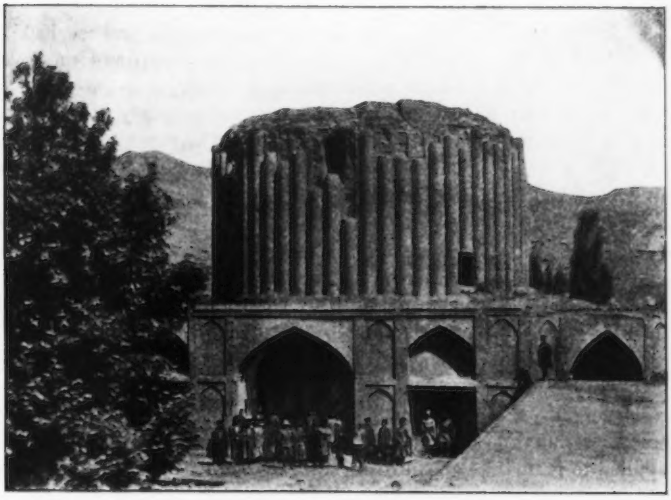
INTERIOR OF KALÁT-I-NÁDIRI, SHOWING SIDE OF NATURAL WALL.

which frowned down upon the sunless shingle of the river bed. The Hebrew writer's "Who will lead me into the strong city? and who will bring me into Edom?" came into my mind as we entered the fort, and I recollected that Edom, like Kalát-i-Nádiri, was a natural fastness of extraordinary strength. The actual *darband* had been recently injured by a flood, and is by no means strong, but at every turn towers or forts supplemented the hand of nature, the whole constituting an impregnable position if held by a resolute force. The *darband* is named after Argawán Sháh, who was referred to above. It is of more than usual interest to recall that it was this monarch who despatched an embassy to China, to the court of Kublei Kaán, and was thus instrumental in procuring the return of Marco Polo to Europe, as he alone was

acquainted with the sea route from China to Persia, and was also deemed sufficiently trustworthy to take charge of the lady Kokachin, who, according to the illustrious Venetian, was "moult bele dame et avenant." Arghun Sháh, furthermore, sent embassies to the pope and to the kings of France and England. In return, Edward I., in 1290 A.D., accredited Geoffrey de Langley to visit the Moghul, with a gift of "some gerfalcons and other jewels of our land." We passed the ruined *darband*, and, a short distance beyond it, stopped to examine an inscription, which is cut in the cliff and beautifully incised. As may be imagined, this record was of great interest, and, after failing in the first attempt, I have secured an excellent photograph of it. The inscription is partly in Persian and partly in Turkish, and is not completed. However, the name of Nádir appears on it, and this alone, apart from the character and decoration, proves that it is chiselled in the honour of the great Afshár, and is not connected, as previous travellers have reported from hearsay, with Arghun. Unfortunately, one section of the inscription has been worn away by the action of water; but I have hopes of recovering the defaced lines, as there is an old gentleman of ninety, a resident of Kakha, who is said to possess a copy of it. So far as it is decipherable, the inscription consists of praise of God and Mohamed, with a reference to Nádir Sháh. To resume, we emerged from the gorge at the village of Argawán Shah, which is inhabited by Jaleiir and Gerashlu Turks, and thenceforward there was a continuous strip of cultivation, with numerous gardens. After passing a ruined ice-house, whence a track leads to the Dehchi *darband*, we skirted a hamlet, termed Khwárizm Mahalla, which is peopled by a few families from Khwárizm, or Khiva, planted by Nádir Sháh, who, like the monarchs of Chaldea, transported tribes from one side of Central Asia to another. Finally, 4 miles from our camp, we reached the governor's residence, known as "Kabud Gunbad," or the "Blue Dome," a name derived from its mosque.

We returned the call of the *Jalíl-ul-Mulk* on historical soil, for he received us in the garden, in which is situated the *Imárat-i-Nádir*, or "Building of Nádir." This consists of a central dome some 90 feet in height, constructed of a variety of stone resembling Devonian sandstone. The interior of the dome was some 50 feet in diameter, and there were traces of decoration in gold, blue, and black. This central dome of fluted pillars was surrounded by four sets of rooms, each consisting of an arch with a chamber on either side. The whole was cased externally with marble, which, with the utter disregard to means displayed by Orientals, was quarried in Urmia, near Tabriz, and transported some 1500 miles from the western to the eastern frontier of Persia by forced labour, and, as Sir John Malcolm testifies, at the cost of much human misery. The stone panels are decorated with exquisitely cut trees and birds chiselled in relief, but some of the panels

are plain, thus presenting an unfinished appearance. Beneath are extensive vaults. This was the famous treasury of Nádir Sháh, and the cellars, rather more than a century and a half ago, contained more bullion and wealth than any conqueror has perhaps amassed since Alexander the Great rifled the hoards of the Achaemenians. The whole is interesting rather than striking; indeed, the design is mean and betrays no grandiose inspiration, such as would be befitting to a thesaurus which included the Dariá-i-Nur, or the still more famous Peacock Throne. After concluding our inspection, we rode to the northern wall, which, unlike the southern, is hidden from the valley by an interior range. Two hours of steep ascent to an altitude of 4500 feet brought us to



THE TREASURE HOUSE OF NÁDIR SHÁH.

the hamlet of Khist, to the west of which, covering several acres, was the palace in which the family of Nádir Sháh was surprised, in the manner already related. The buildings were of coursed stone, and the ruins of a Persian bath were visible; but here again everything presented the same aspect of incompleteness, and the most interesting remains consisted of elaborate masses of masonry which filled the steep valleys, and were designed to store the water-supply. Indeed, to-day, the villagers depend upon these reservoirs, and their crops are fed by the rainfall, there being no springs or irrigation works on these hills. A second ascent brought us, at an elevation of 6000 feet, to the highest peak of the northern wall. As may be supposed, the view was superb; and, from our point of vantage, we looked down on the great plain of

Asia, which stretches in unrivalled monotony to the arctic tundra of Siberia, and is perhaps the most extensive in the world. Almost at our feet lay Doshákh, and Kakha, with the Trans-caspian railway, and, to add to our pleasure, we descried a train running on the famous line, the sight of which, the Indian sowars vowed, made them feel homesick, and recalled to me the joy some yeomen in South Africa expressed at the sight of a mining chimney at Klerksdorp. Tearing ourselves away with difficulty from gazing across the yellow plain, we turned our eyes to the great fort. As mentioned above, the northern face is less regular, and appeared to be less impracticable; but we only saw it from the crest, which is here an easy slope, and the lower portion is said to consist of sheer cliff. Looking into the valley, we saw a maze of low hills, which to the south-east terminated in flat-topped Kuh-i-Bába-Kumeili. But the day was waning, and we had to hasten back to the valley, where everything felt damp and unwholesome compared with the keen mountain air of Khist.

We camped at Kabud Gunbad, and, making an early start on the following morning, rode east down the valley. The river runs between high cliffs, which are united by a remarkable dam some 90 feet wide and perhaps 250 feet in height. It is constructed of red brick, and is said to date from a period anterior to that of Nádir. A few miles lower down, ruined walls mark the site of the once extensive pleasaunce of the Great Conqueror, and, nearing the natural walls of the fort, we passed Deh Nafta, a village inhabited by Khuzái Arabs, whose ancestors were also brought to this happy valley by the same master mind. Below, the river runs through cliffs which attain to an unrivalled pitch of sullen grandeur. Nowhere have I seen anything to match the impressiveness of this impregnable defile, which repulsed Tamerlane's repeated onslaughts, and fully merits the epithet "awesome" which is applied to it by the Persian historian; and here I bring to a close my description of a visit to Kalát-i-Nádiri, which has stamped ineffaceable recollections on my mind.

We quitted Kalát by the Dehchi *darband*, the descent to which is extremely rough. We then skirted the Russo-Persian frontier in a westerly direction, passing the historical village of Charam, which, as related by Firdausi, nestles in the hills. That night we camped at the charming village of Archingán, and, early the next morning, we accompanied Sir Arthur Hardinge to the Russian frontier post of Sang-i-Divár. Here we were most cordially welcomed by the Russian officer in charge, and said good-bye to the minister, who reached Kahka a few hours later, and London in eight days, so miraculously has science brought these solitudes of Central Asia into touch with the Western world. Turning our backs with some regret on civilization, Captain Watson and myself rode due south to the lovely hill village of Khákistar, where we camped under superb walnuts and shot at wood pigeons as

they came in to roost. Khákistar is now the frontier customs post, and there is a great deal of traffic along the route we were to follow back to Meshed, which has, so far as I know, never been followed by any English traveller. The scenery is extremely romantic, being bold though, for once, not forbidding, as the ranges are covered with fine junipers, and in a country like Persia such a sight is refreshing beyond words.

The ascent to the Dalucha pass was extremely steep, but thenceforward we skirted the superb Hazár Masjid range, until we crossed the second of these same mighty spurs, which we had already traversed on the way to Kalát-i-Nádiri; here the junipers ceased and the hillsides became naked. The stage was nearly 30 miles long, and as we had shot for part of the way, we were glad to reach Márishk, a most picturesque village situated at the junction of the two valleys; it is the headquarters of the Chulai tribe. The following day the scenery was still fine, but nothing to what we had left behind, and a short stage brought us back again to Kardeh. Instead of returning to Meshed direct from Kardeh, we rode to inspect the ruins of Tus, which is one of the most historical cities of Khorasán, but is perhaps chiefly famous in Europe as having been the home of Firdausi. Tus is situated in the same fertile valley as Meshed, of which it is the mother city; but apart from the ruined walls and a dome, which is erroneously considered to be the tomb of the great epic poet of Persia, there is little to mark a city which was the theme of the mediæval travellers. But the bridge is of great surpassing interest, as the legend runs that Mahmud of Ghazni regretted his treatment of Firdausi, and sent him camel-loads of gold as a reward for his great poem. The caravan was, however, met by the bier which bore the poet to his grave. Disdaining to accept the monarch's bounty, the money was used by the poet's daughter to build this bridge, and to bring down a stream of water from the hills. To resume, a few hours were quite sufficient for the examination of Tus, and 13 miles more brought us back to Meshed after a ten days' tour, which was one of the most interesting I have ever made.

VI.

In the late autumn of 1905 we started on a tour which was intended to include the chief centres of Eastern Khorasán, a country with which is connected the names of Valentine Baker, MacGregor, Stewart, and Yate. We left Meshed by the Herát road, and traversed the almost level valley of the Kashaf Rud in a south-south-easterly direction to Jimábád, a thriving village of two hundred houses. Thence we rose gradually to the village of Sangbast, where we found a tent pitched for breakfast. The interest of Sangbast centres in a ruined dome and a lofty column, both built of burnt brick. Round the top of the latter, which is in an almost perfect state of preservation, is a Kufic inscription, which was photographed. Eiáz, the vizier of Mahmud of Ghazni,

who was contemporary with Alfred the Great, founded these buildings as a college and tomb for a saint named *Mirza* Abdul Kásim, his religious leader. Until the last generation, there were two of these columns. Two miles beyond Sangbast we camped at the village of Bakirábád, which is inhabited by Yezdis and Kermánis. From Bakirábád we rose steadily for some miles, and, crossing a low range, descended on the plain of Farimán, which is famous in Khorasán for its breed of cattle and general fertility. It was also a favourite place for Turkoman raids, to judge by the numerous towers of refuge which were dotted about like so many pepper-pots. The custom was for the cultivators to fly to these little towers, close the entrance with a stone, and then to stand at bay with their matchlock sticking out of the sole aperture, when they were invariably left alone. We were met close to the village by Captain Watson, who had marched across the range from Turbat-i-Heideri, and who accompanied us throughout this tour.

The six hundred families inhabiting Farimán include Jámis, Karáis, Káinis, and Seistánis.* The fact is, that until the Russians drowned the Turkoman terror in the blood of the man-stealers, these fertile lands were never safe. Nowadays, however, there is a stream of emigration from the less-favoured districts of Persia and Afghanistan, with the result that the prosperity of Khorasán is steadily increasing. The fertility of Farimán depends on its dam, which had recently been repaired by the orders of H.H. the Ain-u-Dola, an ex-grand vizier of Persia. Building was still going on at the time of our visit, although it was merely a case of finishing touches, and we were courteously shown over the works by the Persian field marshal who was in charge. The dam is advantageously situated between two hills composed of a hard rock, just below a point where two or three valleys unite. Its dimensions are: Total length, 366 feet, with a length of actual dam, 160 feet. Its height is 80 feet, and the foundations are sunk to a depth of 28 feet. The width of the masonry, which is faced on both sides with brick, and filled in with boulders set in mortar, is 20 feet. There are two sluices for water, which escapes by a single exit; there is also a flood channel. At the back of the dam is a huge buttress. The work struck me as good, and it will be interesting to see how it stands. If it prove to be a success, it will pay handsomely, and encourage the construction of other similar works.

After examining this fine public work, we rode among low hills to the hamlet of Chahár Gao, which is some 18 miles to the south of Farimán by the direct route. Shortly after our arrival at the hill hamlet, we heard a fusilade, which approached nearer and nearer.

* I may note that both at Meshed and at Turbat-i-Heideri, Captains Battye and Watson are taking a number of anthropometrical measurements, which are considered to be of the utmost ethnological importance.

We were much puzzled as to what was happening, when a crowd of villagers came into sight, escorting a bride to her new home. A *mulla* led the procession and read prayers, the crowd joining heartily in the responses, and volleys were fired at the pauses. The little bride, dressed in scarlet, was seated on a pony in front of an aged and wrinkled dame, who was apparently her mother, and the entire population of men, women, and children marched along in great excitement and formed the escort. Altogether it was quite an old-world scene, and carried one back to times which are far removed from the bustle of to-day.

Leaving this charming hamlet, we rode to the Kalla-i-Minár, or "Pillar of Skulls" pass, which we crossed at an altitude of 7100 feet. Upon inquiring the origin of this sinister name, we were informed that about a century ago a Turkoman built a tower, the ruins of which we saw, and levied blackmail on all passers-by. Any one who objected to be fleeced was promptly decapitated, and his skull was built into a column—to encourage future travellers. The pass was not difficult, but the stage to Kala Aga Hasan, situated across the next valley, was a very long one, and it was dark before the camp came in. From Kala Aga Hasan, which was in the district of Turbat-i-Heideri, we changed direction to south-east down the direct route to Herát, and, at the stage of Himatábád, entered the district of Bákharz. It was near this village that the late Sir Charles MacGregor * had a brush with Turkoman in 1875. The following day we marched down a stream, where we secured a bag of teal and duck, and, camping at the picturesque hamlet of Kabchi, entered Shahr-i-No, the chief village of the district, on the following morning. Bákharz of to-day is divided into three divisions of "Upper," "Middle," and "Lower" Bákharz, which word, it may be mentioned, is a contraction of *Bád Harza*, or "Where the wind blows." Down this belt sweeps the famous north-north-west wind † of Herát, which in Seistán is known as the *Bád-i-Sad-va-Bist-Ruz*, or "Wind of 120 days," to which Sir Henry McMahon has paid homage in his recent paper on the delta of the Helmand, it being indeed impossible to ignore it. As a proof of how the wind influences names, we may also cite the neighbouring district to the east of Bákharz, which is termed Bádghis, and is derived from *Bád Khíz*, or "Wind-stirring." Another point of interest is that this unremitting gale has been used from very early times for grinding grain. Indeed, it is quite possible that, in the mill, we have the prototype of all windmills. At any rate, in Masudi ‡ there is a story which proves that windmills were known to the Persians at the time of the Arab conquest, which is anterior by many centuries to their use in Europe.

* *Vide* his 'Journey through Khorasán,' vol. 1, p. 254.

† To be exact, it blows from 30° west of north.

‡ *Vide* his 'Prairies d'Or,' ed. Barbier de Meynard, vol. 4, p. 227.

I have previously referred to the mixture of peoples in Khorasán, and was consequently not surprised when the leader of our reception party stated that his ancestors were Ansari * Arabs from Medina, who had settled in the district seven centuries ago. The present village is surrounded by extensive gardens, and occupies a site near the ancient Málin, which in the fourth (tenth) century was an important centre. Bad times, however, overtook it, and Málin became the utter ruin it is to-day. Rather more than a century ago, a *Huzára* chief, Mohamed Khán by name, founded Shahr-i-No, which itself has now been deserted, the peasants, thanks to a cessation of raiding, being now able to live on their own property outside the walls of the fort. Close by the ruin of Málin, or Málan, which covers a large mound, was a shrine in honour of *Sheikh* Abdulla, son of the famous *Sheikh* Ahmad of Jam, which was sheltered by a solitary but magnificent pine. Bákharz is always considered to be a fertile district of Khorasán. But for seven years locusts have ravaged it, and the population is thoroughly disheartened and is leaving the district, as no organized effort has been made to cope with this terrible curse, which year after year wrecks the happiness and well-being of the industrious sons of Irán. By no means the least evil of the scourge is that it favours the increase of the opium crop, which is not affected by locusts.

From Shahr-i-No we again made for the hills, our objective now being the historical town of Khaf. On our way we visited a large mere, but shooting was a failure, as there was no means of retrieving the birds which fell, owing to the combination of thick weeds and deep water. We consequently turned our backs on the Bákharz valley and marched uphill to the village of Ustá, the inhabitants of which are all Sunnis. Before continuing the march on the following morning, we explored a most interesting fort, known as the Kuh-i-Sangi. In shape it resembles the famous Mil-i-Farhád of Rudbár, which has already been referred to in this paper, and rises some 1500 feet above the plain in the form of a cone. A steep climb brought us to a level summit, oblong in shape, and perhaps 150 feet in length by 40 feet in breadth. There were four tanks, all of them cut in the living rock, the largest being 30 feet square and perhaps 20 feet in depth. It was lined throughout with brick. Below, on the other peaks, were the remains of what is believed to have been stabling and quarters, and the whole much resembled the fort I visited near Duruh in 1899. The march was a series of sharp ascents, with occasional descents to the pass known as the Kotal-i-Kháki, which we reached at 8 miles from Ustá. There is a second pass some 5 miles to the east, known as Kotal-i-Sangi, but it is practically impassable for laden mules. The altitude of the pass is about 5000 feet. The descent was easy, through fine scenery, to a

* These Arabs were descendants of the party which invited Mohamed to Medina, and have ever since borne the title "the Helpers"

small village in the Khaf district, which we had entered after crossing the pass. Only a few miles were now left to accomplish, and, riding across a level plain, we soon caught sight of the pines for which the little town of Khaf is famous. Outside the ruinous walls we were met by the usual reception, and found our camp pitched in the open, close to the ruined fort.

The district of Khwaf, as it is spelt, has been of note for many centuries, and was famous for its grapes and pomegranates, which latter fruit cannot stand the cold of the Meshed winter. Its general elevation is so much lower than that of Bákharz that it is deemed to be *Garmsir*, or "Hot Country." In mediæval times, Salumak, now Salámi, was the capital of the district. To-day *Ru-i-Kháf*, or "the Face of Khaf," situated some 3 miles to the north-west of the ancient Khargird, is the chief centre. It is generally termed Rui. The town has suffered in importance from the cessation of raids, and is now half deserted, with but two thousand Sunni inhabitants, all of whom wear a dress which consists of a long coat of quilted light blue calico, resembling the Turkoman garb; but, instead of the sheepskin bonnet, they twist a white puggari round their heads. Curiously enough, too, there has been a tiny colony of Hindus at Kháf for some generations. Although hailing from Shikárpur in Sind, like the Kermán and Bandar Abbás colonies, they have no connection with these latter. They are well treated nowadays by the Persian authorities, but did not appear to be prosperous. Hindus are, however, accustomed to conceal their affluence. The redeeming feature of Khaf is its fine pines, which are said to have been brought from the Himalayas. It gave one a touch of home to hear them soughing in the wind, and efforts are now being made to grow these splendid trees in the Meshed consulate. In the range which lies to the south-west of Khaf, which is known as Khoja Yar, games are held at the No Ruz, the vernal equinox, just as in Seistán.* It is almost certain that this is a survival from pre-Mohammedan days, and, as such, is particularly interesting.

The following morning we visited the once famous *madressa* of Khargird.† It is a double-storeyed square, with outside measurements of 160 feet by 150 feet. The main gateway is a noble piece of work, inlaid with coloured bricks, and decorated with a blue mosaic inscription. Of this, the right half, consisting of verses from the Koran, was defaced and illegible; but the left half was copied, and is to the effect that Sháh Rukh, aided by Ahmad of Kháf, constructed the *madressa* in A.H. 848 (A.D. 1444). The interior is built in the usual style round a court with four open arches. The coloured bricks are still intact, but the mosaics, which are exquisite, are almost all defaced. Their colours are sapphire-blue, with yellow, green, and

* *Vide*, 'Ten Thousand Miles in Persia,' pp. 379–380.

† Khargird is said to be a corruption of *Khusru Kard*, or "Khusru's Building."

white, the motive of the pattern being conventional Kufic letters. Captain Watson photographed the best-preserved specimens of this art. Fine mosaic tiles, dark blue, with conventional flowers in light blue, white, and gold, originally covered the interior of the arches; but almost all have been removed, and in a very few years none will be left. On both sides of the main entrance is a domed building, which is decorated with beautiful plasterwork, the paneling to match consisting of white marble hexagons, relieved by sapphire-coloured tiles. This, the finest building which I have yet seen in Khorasán outside Meshed, was the work of Ghiás-u-Dín and of Kawám-u-Dín, both of Shiraz. The latter architect also built the Gauhar Shád mosque of Meshed. The photographs of this erstwhile stately college by no means do it justice, but specimens of the tiles which I was able to procure at Meshed show what a superb building it must have been when Sháh Rukh, son of mighty Tamerlane, received it, in all its glory of blue and gold, from the hands of his architect.

One of my objects in visiting the Kháf district was to complete my general acquaintance with Eastern Persia, and I may perhaps here summarize the various basins or depressions, the last of which, after more than twelve years of travel, I was now visiting. North of the east-to-west ranges of Makrán, which are pierced by various torrents making their way to the Arabian Sea, is the depression of the Mashkel, and further north, again, the main basin of the Helmand, which drains Southern Afghanistan and part of Eastern Persia. These two basins I had examined in 1896 and 1899 respectively. In the latter year, too, on my journey from Sistán to the Káin hills, I had looked across the grim Dasht-i-Naumid,* or "Desert of Despair," itself containing a minor depression, and the Khaf Namaksar, or Salt Lake, is the last of these depressions before the Hari Rud basin, which we were now about to enter, is reached. Khaf was the most southerly point of the tour, on quitting which we marched due east across the level plain, obliquely approaching the range which we had crossed four days previously. At 15 miles there was a low pass in the hills, running down from the main range, which terminated a few miles to the south-east of this point. Crossing the pass, which is termed Dar Darrah, we descended to Karát. This hamlet boasts of a *mil*, or column, which was of two sizes. The lower portion, some 80 feet in height, was octagonal, and had a belt of much defaced Kufic inscription, which we copied. The upper portion, some 60 feet in height and round, was leaning considerably out of the perpendicular, and looked too dangerous to ascend. A staircase led to the top, and, as elsewhere, this column was undoubtedly used as a signal and look-out station. It is said to have been built

* Captain Keyes, H.M. Consul at Turbat-i-Heideri, states that the word is now pronounced Dasht-i-Nammad. Possibly it is a corruption of Náumid.

by Sháh Rukh. Close by, are the ruins of a caravanserai and dam. At Karát we were within a few miles of the Afghan frontier, and to reach Kárez we changed our direction from east to north-east, and skirted the western portion of the Hashtadán plain. After crossing a low range of worn-down hills, we reached the little town of Teiobád, which is by far the largest centre of the district of Bákharz, and can boast of 3500 inhabitants. A few miles beyond was Kárez, which is on the main Meshed-Herát road, and the frontier village of Persia.

THE *KAZI* OF TURBAT-I-SHEIKH-JÁM.

Kárez, to judge from the ruins surrounding it, was of importance in the days of yore; and, at any rate, it possesses considerable interest for us, inasmuch it was the birthplace of Hakím Burkai, in whose honour Moore wrote "The Veiled Prophet of Khorasán." I always think that it is interesting to gain touch with these somewhat legendary figures, and to know that in the second (eighth) century the "Veiled Prophet," as the Arabic is rightly translated, gave much trouble to the Caliph Mahdi, but, being eventually defeated, poisoned all his

followers, and then threw himself into a cauldron of nitric acid rather than submit.

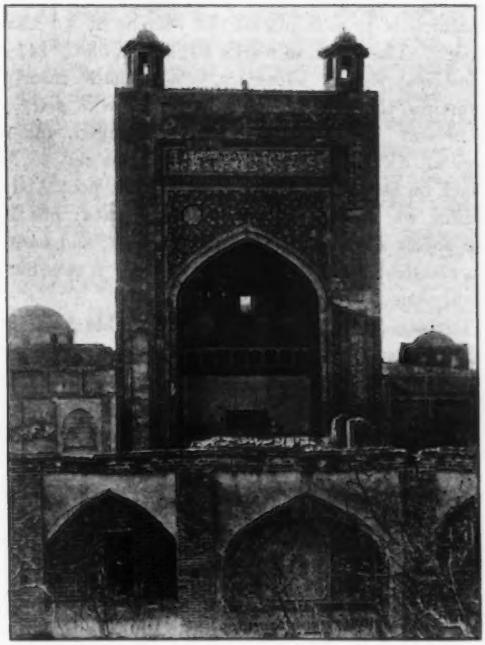
From Kárez we marched north to the Jam river, which, as Sir George Birdwood has pointed out, is the river of Jamshid, "which reveals the present and the future of the world." According to the legend, Jamshid travelled to it every day—here is a form of the Solar myth—and his famous "seven-ringed cup" is, in reality, the Jam Rud reflecting the seven planets, whose revolutions rule the destinies of mankind. For us, among its chief attractions was the hope of some good shooting. Bird-life in Khorasán is scarce compared to what is met with in well-wooded and well-watered England; but, at the same time, there is less of the utter void which is so noticeable in South-east Persia and the terrible Lut. The Jam river, which we struck at Dolatábád, is drawn off to a great extent for purposes of cultivation, but, nevertheless, holds a certain amount of water, and in places is full of reeds. Consequently the shooting for two guns was excellent, as in the marshy sections snipe, redshank, and mallard, teal, widgeon, and pintail ducks, not to mention shovellers, gadwell, and the ruddy sheldrake, abounded, and there were also large flocks of lapwings. As is so often the case, however, we did not enjoy to the full this excellent sport, as we were within a ride of the famous Hari Rud, which, apart from its other attractions, was said to hold pheasants; and, never having shot a pheasant in Persia, we decided to reserve most of our limited number of cartridges for this purpose. We started off down the Jam Rud at an early hour, and, after a ride of some 14 miles, reached the Hari* Rud, the classical Arius. At the point where we struck it, the river flows in a bed, which is from 2 to 3 miles wide, both banks being covered with tamarisk. The river was some 40 yards in width, flowing with a swift current, and difficult to ford except at a few points. The water is very salt in this section, except after a flood. This, then, is the Hari Rud, which, formed by the junction of two streams in the high country to the east of Herát, flows close to the south of that most historical city, and then, curving round due north, forms the boundary between Persia and Afghanistan for some miles. Lower down, it constitutes the Russo-Persian frontier, and, changing its name to the Tejend, is ultimately lost in the all-engulfing sands.

To resume, we beat the tamarisks for about five hours, but only secured partridges and hares, and, as the day was waning, we returned to the Jam Rud, where we enjoyed good sport, and ultimately reached camp several hours after dark. From Dolatábád, we shot our way up the Jam Rud for some miles, and then made across country to the ancient site of Buzján, which, in the fourth (tenth) century was of considerable importance, and the chief town of the district of Jam, which

* Hari, Herat, the classical Arius, Aria, and Aryan are all one and the same word.

we had now entered. There was, however, little to see except a low hill with crumbling walls and bits of pottery, but from it we could descry the lofty gateway of the Jam Shrine, and a few hours later we were camped outside this interesting little town.

Turbat-i-Sheikh-Jam, or "the Tomb of the Sheikh of Jam," to give it its full name, is the first town in Persian territory which was reached by conquerors from the north-east and east; it has consequently borne the brunt of many an invasion. But its fame chiefly depends



THE SHRINE OF *SHEIKH* AHMAD AT TURBAT-I-SHEIKH-JAM.

on its having been the birthplace of *Sheikh* Ahmad, and also of the poet Jámi. The former was of Arab extraction, and flourished in the sixth (twelfth) century; he was famous as a religious teacher, his works being still extant. It was in his honour that the shrine was built, and his descendant, known as the *Kázi*, an old gentleman of ninety, was in charge of this old-world sanctuary when we visited it. The story runs that the shrine was originally built by Sultán Sanjár, the great Seljuk, but that Sháh Abbás destroyed it, on the grounds that the *Sheikh* was a Sunni. However, a document was produced out of the ruins, from

which it appeared that the saint was in reality a *Shiá*, and the penitent monarch vowed that, if he captured Kandahár, he would rebuild the shrine in greater splendour than before. In any case, the great arch referred to above is faced with florid arabesque mosaics in blue and white, with bold yellow scrolls which bear a distinctly Safavi appearance. A strip of blue mosaic with white lettering is the chief motive, but everything is falling into irreparable decay. Indeed, it is remarkable that the tiles should have lasted as long as they have. Behind are two insignificant mosques. The tomb of *Sheikh* Ahmad is very rude, and his epitaph runs, "A famous teacher, an honoured *Sheikh*, Ahmad of Jám, a well-known saint. If thou inquirest the year he died, 'Ahmad of Jám, holy is his dust.'" The last line works out at A.H. 536 (1141), each letter having a numerical value. Close by, is a pathetic inscription of the Emperor Humeiun, then a refugee from India, who married a descendant of the *Sheikh*. However, his fortune changed, and his dynasty in the person of Akbar the Great was yet destined to leave an imperishable mark on the history of India. Of the poet Abdur Rahman, known as Jámi, we heard little in his birthplace: but his mystical and romantic poems are still famous in the East, and he is held to be the last great classical poet of Persia. He died in A.H. 893 (1487), at the age of eighty-one.

Leaving Turbat-i-Sheikh-Jam, with its venerable *Kázi*, its crumbling shrine, and its shady garden, we marched north-east across a difficult range for two stages to Khitái, where we again struck the Hari Rud. Soon after leaving camp on the following day, we sighted the remarkable cliffs of *Dahána* Zulfikar, or "Zulfikar Pass." The legend runs that, Ali cleft it with his forked sword, which the name commemorates. Looking across the river, the cliffs, which offer a singularly good example of erosion in their soft surface, rise sheer to a considerable height, and give the impression of a battlemented wall. Underneath, we sighted the squalid village of Zulfikar, which is held by a *sadbáshi* * and a few Afghan frontier guards. Looking up the gorge, our vision was barred by another evenly serrated cliff, closely resembling that of Kalát-i-Nádiri. It was as if a curtain were drawn to prevent the nakedness of Afghanistán being visible to the curious traveller. Perhaps one mile from the gorge, we saw through our field-glasses two white pillars, which are the actual point where the two empires of India and Russia meet, and from our side of the Hari Rud, barren Irán stretched for hundreds of miles to the west and south, and constitutes yet a third empire. We first came opposite the pass in the white glare so well known to frontier officers; but when evening touched it with her magic wand, each sombre crag was lighted up and glorified by colours of every hue, and it was perhaps at this time that the impressiveness of what is, in reality, the north-western

* A *sadbáshi* is the Oriental equivalent of a centurion.

boundary of the Indian Empire was for the first time fully realized by us. We camped opposite Zulfikár pass, to enjoy its stern beauty to the utmost; and a short march on the following day brought us to Zorabád, which is a frontier station, and is garrisoned by a small number of Persian troops. Unfortunately it is unhealthy, about one-half of the population having been prostrate with fever a few days before our arrival. Zorabád is inhabited by fifty families of the Organji tribe, who migrated from Khiva a generation ago.

From Zorabád two short stages brought us to the Kashaf Rud, the water of which was extremely salt, so much so that our horses declined to drink it. At Bágh-i-Bághu, however, we at last secured some pheasants, the *Phasianus principalis*, specimens of which I have given to the Natural History Museum. Here we were within three stages of Meshed, and a few days later returned to our headquarters, after accomplishing yet another tour of great interest, during which I had added considerably to my knowledge of Eastern Khorasán.

In April, 1906, I was granted leave, and, as every hour was precious, I travelled to Kakha in two days, and managed to reach London on the tenth day, after bidding a temporary farewell to the capital of Khorasán.

Before the paper the PRESIDENT: I am dispensed to-night from introducing to you the reader of the paper, Major Sykes, because you all know him. It is now some years since he produced his work on Persia, which was the result of eight years of study there. His name will always be connected with the country of Persia, and I should like, before asking him to read his paper, to indicate the opinion in which he is held by one of the highest authorities in this country on subjects connected with countries in close relation to our great dependency—I mean Lord Curzon of Kedleston, our distinguished Vice-President. Some three weeks ago, speaking at a meeting where Major Sykes was delivering a paper on the Parsees of Persia, Lord Curzon said of Major Sykes, among other complimentary remarks, that there was no living Englishman with a greater knowledge of Persia. Such testimony makes it unnecessary for me to say anything further. I will now call upon Major Sykes to read his paper.

After the paper, the PRESIDENT: I will now call on a member of a profession which is not forbidden to speak to the public. I see here one of its most distinguished representatives, Mr. Chirol, to whom the general public owe a great part of their knowledge of Persian affairs and of the relations of Persia to this country.

Mr. CHIROL commented briefly on the terrible state of decay into which Persia had fallen. Every traveller was struck by it, and Major Sykes's paper had afforded fresh evidence of it. The rivalry of Great Britain and Russia had the effect of preventing the Persians from taking the remedy into their own hands, as Nadir Shah and other strong men had done in olden days, who, from time to time, by dint of personal power and measures which we should call revolutionary, pulled the State out of its rut and created a new order of things which continued until another period of decay came, when the process was repeated. "Now," a Persian once remarked to him at Shiraz, "even that resource is taken from us, because the whole effect of the rivalry of the two great powers in Persia is to bolster up a *régime* which we Persians, who have some knowledge of the conditions in other

countries, know to be absolutely effete." Undoubtedly that had been one of the most unfortunate results of the rivalry between the two powers; and from that point of view, perhaps, as much as from any other, an Anglo-Russian understanding might help to restore Persia to something of her former position and prosperity.

Sir Thomas Holdich: I should like to say just a few words on the geography of the country about which Major Sykes has spoken to-night, because, interesting as that country is to us now, it is bound to be far more interesting hereafter. He has taken us to the extreme north-west corner of the country called Khorasán, which now includes only a part of Eastern Persia. The time was, and not so long ago, when Khorasán meant the whole of Afghanistan, and extended across the Indian frontier as far as the gates of Lahore. Incidentally, it has been of great interest to me to hear that the two first pillars of that historical boundary between Russia and Afghanistan that we set up with so much care and difficulty, say, twenty years ago, are so well preserved as to be visible from the opposite side of the Hari Rud river. It is a surprise, and I must say a pleasant surprise, to me to learn that these pillars are so well nursed, and that they are whitewashed and polished even as our pillar-boxes may be polished in London. But of far greater interest, I think, is a fact to which Major Sykes has not alluded in his paper, viz. that it took him exactly nine and a half days to get from Meshed to London. Now, this fact opens up a great vista for the future. It is along this line that, in future times, East and West will be chiefly connected, and it is on this route that future generations —generations, perhaps, that I shall not see—will find their way from the shores of England to the plains of India. If you will refer to the map, I should like to point out to you that from Askabád on the Russian line of railway north of the mountains to Herat is about as far as it is from London to Edinburgh. From Herat by Kandahar to Quetta is about twice as far. You may take it, then, that from Quetta to Askabád is about two and a half days' journey, if you could make that journey by rail; about the same length of journey as Major Sykes made from Meshed to Askabád. Consequently, it seems to me that it will be possible in future to bring India, even at the present rate of railway progression, within nine days of London. Of course, I am aware that Quetta is not exactly in India; nevertheless, Quetta may be reckoned nowadays as an Indian station. Well, there are two or three ways of getting to Quetta, and as all these ways more or less touch upon Khorasán, perhaps I may be allowed to tell you a little about the geographical conformation of that country from personal experience. Between the Russian railway and Meshed there lies a band of very difficult mountains. In fact, the whole country is mountainous, and, so far as I know, there is no royal road across it; it would be a matter of immense difficulty to bridge the distance between Askabád and Meshed. From Meshed southwards to about the latitude of Herat there are still considerable difficulties. Again, bands of hills in regular order running from north-west to south-east present themselves transversely to any line which may be carried across that interval. The hills themselves are, perhaps, not great in altitude, but they are close set and the valleys are narrow, and there would be great difficulty in crossing them with any line projected for railway purposes. But from that point level with Herat south-west to Seistan no vast difficulties occur. It is difficult, I admit, all the way, but not so difficult as it is further north. Having reached Seistan, what do you find? I have visited Seistan, and we have heard something about it from Sir Henry McMahon in this room a few days ago. Seistan is a country which might almost be called God-forsaken. There, we are told, the spring is heralded by snakes; there we encounter a terrific wind, which is only tolerable because it sweeps away hoards of pestiferous

insects which would make life impossible; there, in the course of a single week of hot weather, you might very well sample all the plagues of Egypt. There should be no mistake about it—Seistan is not a white man's country. Passing Seistan southwards, you must remember you are still in Persia; it is a point which is sometimes overlooked, that if we want to reach Seistan from India we must pass through Persia. Finally, there is that inevitable desert to be crossed between the Persian frontier and Nushki (leading to Quetta), where all the sand and detritus of the Helmand river accumulates by reason of those north-western winds which blow all the year round. It is not a pleasant prospect taken as a whole, and looking at it from a traveller's point of view, one would say that the route generally between Askabád and Quetta, through Seistan, is about as unpleasant a route as you could well choose.

Now about the geography of the Afghan frontier. From Askabád to Merv, and from Merv to Khushk, there is open country which is of no very great interest. From Khushk, as you ascend to the mountains, you pass into a cool atmosphere and a pleasant climate. Crossing those mountains by the Baba, or any other easy pass, you run down the smooth slopes leading to the Herat valley. Once in the Herat valley you are in a sort of oasis, which is not exactly in the middle of a desert as is often represented, but it is distinctly the most fertile and the best developed region in that part of Afghanistan. From Herat again you might expect to meet considerable difficulties in the matter of hill ranges, intervening between itself and Kandahar to the south; but as a matter of fact there is an open way, and no important obstacle. You would pass by several places which are of considerable importance. First there is Sabzawár, which is a very flourishing city. It has always been a green place, as its name denotes, but since the demarcation of the Afghan boundary, Sabzawár has risen to considerable importance. I believe as a centre of trade it now almost rivals Herat itself. Southwards you pass by various places, among others the little hill town of Adraskand, prettily situated, where there is a considerable manufacture of carpets. The carpets turned out there are not equal, either in appearance or in value, to those which Major Sykes has kindly exhibited to-night, but nevertheless they are very passable and very useful. South-west of Adraskand you again tap an agricultural country, of which the capital is Farah; perhaps not an ideal place for residence, for it partakes a little too much of the characteristics of Seistan. You will see that it is about on the same level. Turning eastwards, you run through an open country leading to that great plain of Bakwa, which we are told by Colonel Yate is (according to tradition) the plain on which the final destinies of India are to be fought out between Russia and England. And so to Kandahar, from which point I need follow the Afghan route no further. From Kandahar to Quetta—we all know something of that route. Now, the whole of that Afghan line of approach to India is comparatively easy, so far as gradients and alignment are concerned, and it has certainly the advantage of a magnificent climate. I am only dealing strictly with the geographical aspects of two routes—the Russian and the Afghan; but I may say plainly that between the Afghan route and that running through Seistan, the highland or Afghan route is infinitely preferable from every point of view. It would be interesting to follow this subject further, but I feel I am treading on comparatively thin ice, and I must confine myself to geography. In my own mind I am firmly convinced that the time will come when the great systems of railways which exist in Russia, and those which have been built up by our own energy in India, will be connected by steel links formed by the lines of an international railway.

Colonel C. E. YATE: I will not enter to-night upon any discussion on the

subject of a junction between the Indian and Trans-Caspian railways raised by Sir Thomas Holdich. Sir Thomas is in favour of such a junction, and I am against it. We have often discussed the question, and our views are diametrically opposed, and as it happens that my views are fully stated in this month's (June, 1906) *Nineteenth Century*, I will say no more on the matter at present, but turn to the subject before us.

I need not say that I have followed Major Sykes's lecture throughout with great interest. He has carried me back through many of the scenes and to many of the places I visited when I was consul-general at Meshed ten and twelve years ago, and I congratulate him on his description of those places, and I also congratulate Mr. Herbert Sykes on the illustrations he has so kindly provided for our enjoyment this evening. Major Sykes has not had time to give us a half or a quarter of the varied information he has collected and put down in his paper, and for the perusal of that in full we shall have to wait for the publication of the *Geographical Journal*. Meanwhile, I will just touch upon one or two points connected with his various tours.

One thing specially struck me with regret, and that was to hear from him of the destruction of all the beautiful mosaic tilework that adorned the arches and inner walls of the old madrassah or school at Khargird, near Khaf. When I visited this madrassah in 1894 it was still in a fair state of preservation, and the glazed tilework was nearly perfect—so much so that I noted in my book on 'Khurasan and Seistan' that it ought to remain as long as wind and weather permitted. That this beautiful mosaicwork should have been so ruthlessly destroyed by the hand of man is a loss to the world in general. The only other example of this art that I know of in that part of the country was the old Musalla, or place of prayer, at Herat. The remains of that beautiful building were levelled to the ground by the order of the late Amir, Abdur Rahman, of Afghanistan, in 1885, and as I was at Herat at the time I was able to collect a few specimens of the mosaic tilework that adorned the front of it, and these I presented the other day to the new museum that we founded at Quetta shortly before I left. I am now asking that one or two of those specimens may be given to the British Museum, as now that this madrassah has gone as well, the difficulty of getting specimens of this ancient art will become more and more difficult every year.

I must specially congratulate Major Sykes, and also Mrs. Sykes and their infant son, on their journey across the desert from Yezd to Tabas. When one hears of such long waterless marches as those done by Mrs. and Miss Sykes in this journey, and also of those previously done by Miss Sykes, it shows what can be done by ladies in Persia when the spirit is willing and the flesh is not weak.

In Major Sykes's account of his tours in Kerman, the description of the shrine of the famous saint, Shah Niamat Ulla, at Mahun was of special interest to me. This saint was the author of the prophecy, that Major Sykes and Sir Thomas Holdich have referred to, regarding the great battle that is to be fought on the Dasht-i-Bakwa, a plain in Afghanistan about halfway between Kandahar and Herat. This prophecy is interpreted by the Afghans to apply to England and Russia, and I first heard of it somewhere near Balkh in Afghan-Turkestan in 1886. Subsequently I had it quoted to me in various other places in Afghanistan, but none of the Afghans who told me of it could tell me who was the author of the prophecy, and it was not till I got to Meshed in 1893 that I succeeded in tracing it to the particular saint whose resting-place at Mahun has now been so graphically described by Major Sykes. The Afghans firmly believe that the great battle for the supremacy of Asia is to be fought out between the English and the Russians on this Bakwa plain, but none of them could tell me who was to be the victor.

The tradition is that so severe is to be the fight that at the conclusion of the battle 12,000 riderless horses will be found wandering over the plain, and as part of General Skobeloff's scheme for the invasion of India was "to organize hordes of Asiatic horsemen, who, to a cry of blood and plunder, were to be launched against India," I think we may congratulate ourselves, from the numbers of horses referred to in the prophecy, that it is these Asiatic horsemen who are to get the worst of it, and our minds may therefore be at rest on that account. It would be interesting, though, to know the exact words in which the saint recorded this much-talked-of prophecy. I tried my best to get a copy of the saint's writings when I was in Persia, but without success. They are very rare, and exist only in manuscript, and if Major Sykes ever succeeds in finding a copy, I trust he will not fail to let the world know the exact rendering of this passage.

Major Sykes has told us something of the new Central Persian telegraph line that promises in future to form our main line of communication between India and England. This line, taking off from the main Teheran-Bushire line at Kashan, has been laid on the Persian side through Yezd, Kerman, and Bam to Kohi-Malik Siah, that curious rocky hill on the Seistan border that forms the tribeyt of India, Persia, and Afghanistan. Here it has been joined by the Indian telegraph line from Quetta and Nushki, laid along the Quetta-Seistan trade route. This junction at Koh-i-Malik Siah is now to be supplemented by another line from Karachi *vid* Las Bela, Panjghur and Palantak to Koh-i-Malik Siah, thus giving direct communication from India with Persia and England through both Quetta and Karachi. Now that India has done so much to open up communications and to stimulate trade on her side of the frontier, we can only trust that Persia will see that it is to her interest to do something also. I hope, therefore, that arrangements will now be made with the Persian Government for the linking up of the Persian line from Meshed to Seistan with the other three lines at Koh-i-Malik Siah. The distance from Nasratabad in Seistan to Koh-i-Malik Siah is only 80 miles, and this small extension would give an alternative line of communication in case of any accident on the other lines.

I have never visited Kerman, and I have not seen the Mission hospital there, but I would take the present opportunity of joining Major Sykes in bearing testimony to the good work done in such places by the Church Missionary Society's medical missionaries. I know Dr. Summerhayes, whom Major Sykes has mentioned, well; he and his colleague Dr. Holland had charge of the Church Missionary Society's hospital at Quetta during the four years I was Chief Commissioner of Baluchistan, and I had thus full opportunity of studying their work. Dr. Summerhayes's life is indeed the hard-working, self-sacrificing life that Major Sykes has depicted, and his devoted and unselfish work will, I hope, receive the acknowledgment that is its due.

In conclusion, there is just one more point that I would touch upon, and that is the question of the roads between Bandar Abbas and Kerman. I had hoped to hear something about them to-night, but Major Sykes has only mentioned one of these roads—that by Gulaskhird, which I gather is some 300 miles in length—and nothing has been said as to their practicability for a railway or otherwise. Major Sykes, however, has told us that Bandar Abbas is situated close to natural gates leading into Persia, and that Bandar Abbas will, in his opinion, ultimately become the chief port of Southern Persia. The subject is a specially interesting one at the present time when we have had various articles and discussions on projected Russian railways in Persia, and especially on the proposed Russian railway line from Teheran to Bandar Abbas. I would beg to ask Major Sykes, therefore, before the proceedings close to-night, to tell us something of the different routes

leading up from Bandar Abbas to the Kerman plateau, and to say whether he considers any of them practicable for a railway except at prohibitive cost, and, roughly speaking, what the length of such a line would be, and what chance there would be of its paying.

The PRESIDENT: We must close the discussion now, and leave Major Sykes to give us the information for which Colonel Yates asked him. Before we pass a vote of thanks, I would draw your attention to the fact that in the Tea Room there is an extremely interesting collection. There are bronze ornaments, bronze weapons, and vessels which were found to the west of Kerman, and are the only articles of the Bronze Age which have been found on the Iran plateau. The blue tiles, the embroideries, and the copper-work are also interesting. I now propose a hearty vote of thanks to Major Sykes for his most valuable address, and also for having drawn forth such an extremely interesting discussion.

Major SYKES: I would in the first place thank you, sir, for the very kind remarks you have made about me, and I thank the audience for the kind way in which they have listened to my paper. As to the tracks from Bandar Abbas to the interior, I would say that there are four or five, but the one I referred to in my paper is the lowest in altitude, and it is the one by which, I would mention, Krateros, with the elephants returning from Alexander the Great's expedition in India, chose, and I think that it is the easiest pass. In conclusion, I would again thank you for the very kind manner in which you have listened to my paper.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART XII.—THE LOCHS OF THE LOCHY BASIN.

THE Lochy basin is a large and important one, having on its boundary-line and within it some of the highest peaks in Scotland, including the highest—Ben Nevis. It stretches from Sgor nan Coireachan on the west to Meall Cruaidh and Creag Ruadh on the east, a distance of over 40 miles, and from Glas Bheinn and Leim Uilleim on the south to Carn Dearg and Carn Leac on the north, a distance of over 20 miles, the total area of the basin exceeding 400 square miles. Within this basin ten lochs were sounded by the Lake Survey staff, viz. Lochs Lochy, Arkaig, Pattack, na h-Earba (east and west), Laggan, Ossian, Ghuilbinn, Treig, and an Dubh Lochan. Five of the lochs exceed 3 miles in length, and four exceed 5 miles in length, while one of them (Loch Arkaig) is 12 miles in length; five of them exceed 100 feet in depth, and three exceed 300 feet in depth, while one of them (Loch Lochy) exceeds 500 feet in depth. It has been found convenient to include in this paper also two small lochs which drain directly into Loch Linnhe, viz., Lochan Lùnn dà-Bhrà on the east and Loch nan Gabhar on the west. Loch nan Gabhar is in Argyllshire, while all the remaining lochs are situated in Inverness-shire. The relative positions of the lochs and

* Plates, p. 664.

rivers within the area under discussion are shown in the little index map (Fig. 1), from which it will be seen that Loch Arkaig drains into Loch Lochy by the short river Arkaig, while the other lochs within the basin drain into the river Spean, which joins the river Lochy shortly after its exit from Loch Lochy, the junction of the two rivers being marked by the pretty falls of Mucomir.

The Lochy basin, only a small portion of which has been mapped by the Geological Survey, lies wholly within the region of the crystalline schists of the Central Highlands. It is intersected by the powerful north-east and south-west fault that traverses the Great Glen from

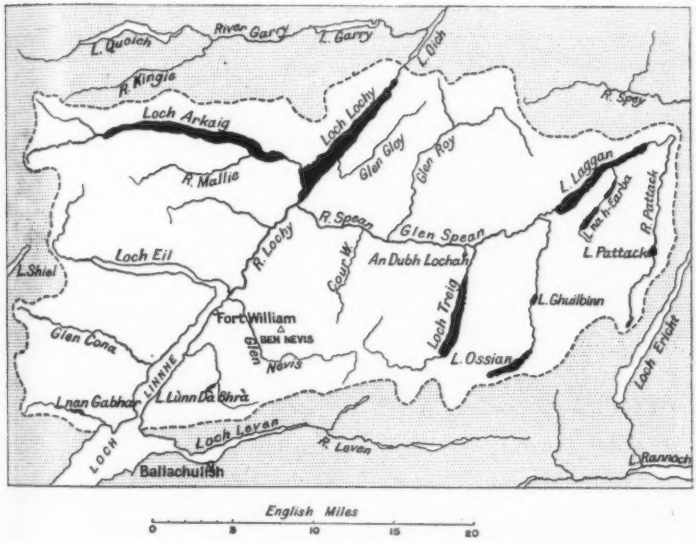


FIG. 1.—INDEX MAP OF THE LOCHY DISTRICT.

Inverness to the shores of Loch Linnhe. In the area west of this dislocation the rocks, so far as known, consist of quartz-biotite granulites and muscovite-biotite schists, which are believed to represent altered sediments. These are traversed by acid and basic intrusions and numerous veins of granite and pegmatite.

East of the Great Glen several of the metamorphic groups of the Eastern Highlands are represented, including the Perthshire quartzite, black schist, limestone, Ardrishaig phyllites, and the associated quartzite, the beds striking generally in a north-east and south-west direction. These schists are pierced by various masses of igneous rock, of which the most important is the large intrusion of granite forming the lower

part of Ben Nevis. It is capped by andesitic lavas, breccias, and tuffs, presumably of Lower Old Red Sandstone age.

Loch Lochy (see Plate I.).—Loch Lochy is the southernmost of the chain of lochs occupying the Great Glen, which were utilized in forming the Caledonian Canal. Its southern end is about 8 miles north of Fort William. It is a straight loch, running nearly north-east to south-west. In form Loch Lochy is a narrow triangle, with the apex at the north end, gradually widening southward to near Bunarkaig, where the greatest breadth is found, after which it rapidly narrows for the remaining 2 miles to the outflow at Gairlochy. A good road runs along

FIG. 2.—LOCH LOCHY, FROM THE SOUTHERN END.
(*Photograph by Mr. James Chumley.*)

the eastern shore, a rough cart-road on the western side, and several stations of the Invergarry and Fort Augustus railway now give easy access to the loch on the east side. The surroundings are wild, gloomy, and solitary (see Fig. 2). No village is found on its shores, an occasional house being passed on the east side, while the west side is uninhabited save for one or two distant cots.

The hills on the west rise with a uniform very steep slope to a height of more than 3000 feet (Sron a Choire Ghairbh), broken only by the deep gashes torn by the torrents in the glacial *débris*, which here extends far up the mountains. On the east the slope is about the same

but the hills less high, the ridge (almost wholly covered with *débris*) which separates Loch Lochy from Glen Gloy reaching to 2000 feet.

The only important streams feeding the loch are the river Arkaig, bearing the superfluent waters from Loch Arkaig, entering near the lower end, and a large burn coming down Glen Gloy, the rest of the feeders being mere mountain torrents. A very small portion of the overflow of Loch Oich enters Loch Lochy by the Caledonian Canal.

The length of the loch is a little under 10 miles, the greatest breadth 1¼ miles, opposite the mouth of the Arkaig, and the average breadth three-fifths of a mile. The greatest depth is 531 feet, and the mean depth 229 feet. The loch has a superficial area of nearly 6 square miles, and drains directly an area of about 58 square miles, but as it receives the outflow from Loch Arkaig the total drainage area is nearly 124 square miles. The overflow of Loch Lochy is carried by the river Lochy into Loch Linnhe.

The survey of the loch occupied from April 28 to May 1, 1903; the height of the surface above sea-level on commencing the survey was found to be 94·24 feet, as compared with 93·2 feet observed by the officers of the Ordnance Survey on July 1, 1870. Loch Lochy contains 37,726 millions of cubic feet of water, or nearly 50 per cent. more than Loch Arkaig, the second largest loch in the basin.

At the north end a small basin, called Ceann Loch, measuring one-half by one-third of a mile, and having a maximum depth of 66 feet, is cut off from the main loch by a narrow channel in which the greatest depth is 40 feet.

The main loch is a simple basin, with the U-shaped section characteristic of glacier-formed lakes. All the contours are continuous, those at 50 and 100 feet enclosing areas little less than the total length of the loch. The area enclosed by the 200-feet contour measures 6½ miles in length, by the 300-feet contour 4¾ miles, and by the 400-feet contour a little over 3 miles in length. The 500-feet contour encloses a very small area, one-third of a mile long by one-eighth of a mile broad, just about the middle of the loch, and includes the deepest sounding in 531 feet. From opposite the mouth of the river Arkaig to the outflow, the loch shallows rapidly and the contours are irregular.

The following table gives the approximate areas between the consecutive contour-lines drawn in at intervals of 100-feet, with the percentages to the total area of the loch:—

Feet.	Acres.	Per cent.
0 to 100	923 ...	24·4
100 „ 200	937 ...	24·8
200 „ 300	651 ...	17·2
300 „ 400	571 ...	15·1
400 „ 500	678 ...	17·9
Over 500	23 ...	0·6
	3783	100·0

The flat-bottomed character of the basin is indicated by the comparatively large area covered by water between 400 and 500 feet in depth, an area greater than in the two shallower zones; the zone between 100 and 200 feet, also, is rather larger than the shore zone.

*Temperature Observations.**—The surface temperature varied from 43°·5 Fahr. to 42°·1. A series taken on April 29 showed the small range from the surface to 425 feet of only 1°·2. It will be seen from the table that the change is very gradual, but quickest in the upper 50 feet, where half of the total range occurs:—

Surface ...	42°·7 Fahr.
10 feet ...	42°·5 „
50 „ ...	42°·1 „
100 „ ...	42°·1 „
150 „ ...	41°·9 „
200 „ ...	41°·7 „
300 „ ...	41°·7 „
350 „ ...	41°·6 „
400 „ ...	41°·5 „
425 „ ...	41°·5 „

Loch Arkaig (see Plate II.).—Loch Arkaig is a long, narrow, curved loch, running nearly due east and west, the lower end about 1 mile west of Loch Lochy and 10 miles north of Fort William.

The lower part of the loch is well wooded, picturesque, and romantic, with hills to north and south, reaching well over 2000 feet in height (see Fig. 3). The upper part is barer and grander, the mountains exceeding 3000 feet in height. A road runs along the north side of the loch, deteriorating towards the west end into a rough track which leads to Loch Nevis and Loch Morar. Several wooded islands enhance the charm of the scenery, and on one of these is one of the few nesting-places of the osprey, still occupied by the birds at the time the survey was made. There is very good fishing in Loch Arkaig, and lake trout up to 10 lbs. in weight were taken from the loch while the survey was going on.

Loch Arkaig is 12 miles long, of somewhat irregular outline, but broadest in the middle parts and tapering towards each end. The greatest breadth is nearly a mile, the mean breadth half a mile. The maximum depth is 359 feet, the mean depth 152¾ feet. The surface has

* During the past twenty years Sir John Murray has taken many temperature observations in Loch Lochy, and has published and discussed the results in the following papers, to which the reader is referred for further details: (1) "On the Effects of Winds on the Distribution of Temperature in the Sea- and Fresh-water Lochs of the West of Scotland," *Scott. Geogr. Mag.*, vol. 4, p. 345, 1888; (2) "On the Temperature of the Salt- and Fresh-water Lochs of the West of Scotland, at Different Depths and Seasons, during the years 1887 and 1888," *Proc. Roy. Soc. Edin.*, vol. 18, p. 139, 1891; (3) "Some Observations on the Temperature of the Water of the Scottish Fresh-water Lochs," *Scott. Geogr. Mag.*, vol. 13, p. 1, 1897.

an area of 6¼ square miles, and the loch drains an area of 66 square miles. The volume of water is estimated at 26,573 millions of cubic feet.

No large loch drains into Loch Arkaig, but several very small lochs do so, the largest being Loch a' Bhlair, a mile to the north. The chief streams enter at the west end, where a short river brings the drainage of Glens Pean and Dessary, and on the south side, where the stream from Glen Camgharaidh enters near the upper end, and that from Glen Mallie

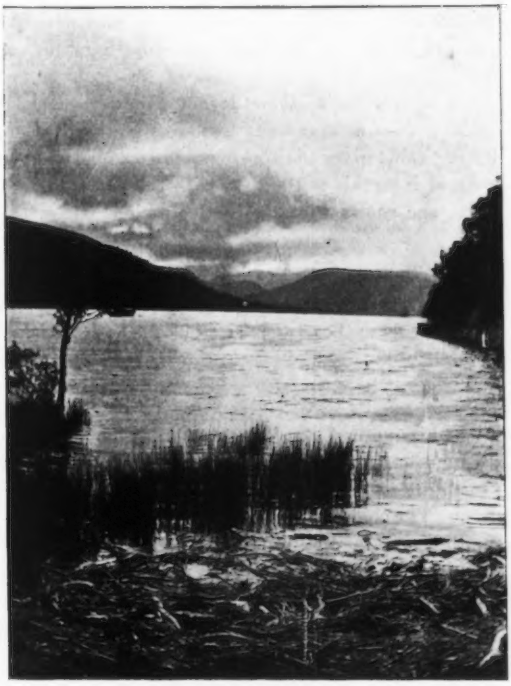


FIG. 3.—LOCH ARKAIG, FROM THE EAST END.
(*Photograph by Mr. James Chumley.*)

near the lower end. Only mountain torrents enter on the north. The river Arkaig, a mile long, conveys the overflow of Loch Arkaig into Loch Lochy.

When surveyed, in the middle of June, 1902, the height above sea-level was found to be 139 feet; the officers of the Ordnance Survey found the elevation to be 139·8 feet above the sea on July 10, 1869.

The basin of Loch Arkaig is nearly simple, the slight irregularities doubtless correlated with the curving outline. The contours at 50 feet

and 100 feet are continuous. A little over 2 miles from the west end of the loch there is an abrupt narrowing, and the loch continues narrow to the end. Corresponding with this the 200-feet contour is broken into two basins. In the narrow western part is a separate 200-feet basin, with a maximum depth of 262 feet; this is only separated from the main 200-feet basin by a slight shallowing to 183 feet. The main 200-feet basin is about 8 miles long; it includes three areas of over 300 feet, which, however, are only separated by very slight shallowings. The largest of these 300-feet areas is about 2 miles long, is situated just about the middle of the loch, and includes the maximum depth of 359 feet. The others, further to the east, are close together, and of very slight extent. Though the wide portion of the loch, fully 9 miles in length, forms a simple basin, there is not the well-marked U-section found in typical glacier-formed lochs (see cross-section E–F on map).

The following table gives the approximate areas between the contour-lines laid down at intervals of 100 feet, with the percentages to the total area of the loch, and shows a gradually decreasing area with increasing depth:—

Feet.	Acres.	Per cent.
0 to 100	1412 ...	35·3
100 „ 200	1257 ...	31·5
200 „ 300	1073 ...	26·9
Over 300	253 ...	6·3
	3995	100·0

Through the kindness of Mr. Thomas Honeyman, factor to Cameron of Lochiel, we have inspected a bathymetrical chart of Loch Arkaig, based upon soundings taken in 1889 by an officer in the German army named Sandler. The chart is drawn to the scale of $1\frac{3}{4}$ inches to the mile, and the soundings are given in fathoms. A comparison of Sandler's map with the Lake Survey map shows that: (1) Sandler's soundings are much less numerous than those taken by the Lake Survey, and many of his lines were taken in zigzag fashion instead of running at right angles to the axis of the loch; (2) Though there is a general agreement between the two maps, the Lake Survey map shows as a rule rather deeper water, position for position; for instance, taking the deepest soundings on each of Sandler's lines, and placing it approximately on the Lake Survey map, deeper soundings occur in the vicinity; thus Sandler's deepest sounding in 55 fathoms (330 feet) approximates to the Lake Survey maximum in 359 feet.

Temperature Observations.—The surface temperature in the centre of the loch varied from 48°·3 Fahr. to 51°·5 during the three days of the survey; near shore it reached 52°·3 on June 13. A series taken in the main basin on June 11 showed a range of 4°·7 from the surface to 280 feet, the greatest variation being observed in the superficial layers of water, as shown in the accompanying table:—

Surface ...	49°·4 Fahr.
10 feet ...	48°·9 „
25 „ ...	47°·5 „
50 „ ...	46°·5 „
100 „ ...	45°·5 „
150 „ ...	45°·0 „
200 „ ...	44°·9 „
250 „ ...	44°·7 „
280 „ ...	44°·7 „

Loch Pattack (see Plate VII.).—Loch Pattack (or Pattaig) lies at a considerable elevation among the mountains which separate Loch Ericht from Loch Laggan. It is only about 2 miles distant from Loch Ericht, though it belongs to a different drainage system, draining by the river Pattack, some 9 miles long, into the upper end of Loch Laggan. It is a loch of somewhat irregular form, about a mile long by half a mile broad, its long axis running nearly north-east and south-west. The maximum depth is 58 feet, and the mean depth 14 feet. The volume of water is estimated at 106 million cubic feet. The superficial area is about 173 acres, or fully a quarter of a square mile, and it drains an area of 18 square miles. It receives the greater part of the drainage of the east side of the mountain mass, of which Ben Alder (3757 feet) is the highest peak. In this drainage area are three smaller lochs, which were not surveyed. When surveyed in May, 1904, the height above sea-level was estimated (from spot-levels) at 1419 feet.

The basin is quite simple, the contours roughly following the irregular outline of the shore, and the deepest part almost in the centre of the loch. The slopes are gentle, except opposite the mouths of the two rivers, both of which have laid down alluvial promontories, with small islands, from which the incline to the deepest water is rapid. The loch is on the whole shallow, for 78 per cent. of the lake-floor is covered by less than 20 feet of water, and 60 per cent. by less than 10 feet of water.

Temperature Observations.—A series of temperatures, taken in the deepest part of the loch, gave 42°·6 Fahr. at the surface, 41°·4 at 25 feet, and 40°·8 at 50 feet.

Lochan na h-Earba (see Plate III.).—The two lochs which bear this name may have formed at no very distant date a single loch, as suggested by the common name and by the appearance of the ground. Be that as it may, they are now two distinct lochs, differing by nearly 10 feet in level. In April, 1873, the Ordnance Survey officers found the elevation of the west loch to be 1151·7 feet, and that of the east loch 1142·3 feet, above sea-level. They lie in a valley, which runs nearly parallel to that occupied by Loch Laggan, to the south side of that loch, and distant from it about a mile. Hills of over 3000 feet rise close on the east; on the west they are separated from Loch Laggan by a ridge

of between 2000 and 2500 feet in height. The shores are for the most part wooded.

The West Loch.—This is the larger, broader, and deeper of the two. It lies at an elevation of about 1150 feet, some 330 feet higher than Loch Laggan. It is fully 1¾ miles in length, rather less than one-third of a mile in greatest breadth, and a quarter of a mile in mean breadth. The greatest depth is 81 feet, the mean depth over 35½ feet. It has a superficial area of about 263 acres, or less than half a square mile, and drains an area of fully 5 square miles. The volume of water amounts to 408 millions of cubic feet. The loch is fed chiefly by two small streams, coming down from Beinn a' Chlachair, which unite just before entering the loch. A stream, half a mile long, winds through a boggy flat, conveying the overflow to the east loch. The long narrow loch is nearly straight. From the centre it narrows to the outflow, but southwestward to the upper end the width is nearly uniform, the end rectangular, straight, and a quarter of a mile across.

The basin is quite simple, none of the contour lines being broken. The contours do not closely follow the shore-line; they narrow more decidedly than the outline from the centre to each end, the slopes being much steeper towards the centre of the loch, where the sections are U-shaped. The deepest part is rather to the east of the centre, and it is curious to note in close proximity an elevation with only 30 feet on it, surrounded on all sides by water exceeding 50 feet in depth.

The approximate areas between the contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	102 ...	38·7
25 „ 50	85 ...	32·2
50 „ 75	67 ...	25·6
Over 75	9 ...	3·5
	263	100·0

Temperature Observations.—A series of temperatures at the deepest part of the loch showed a range 4°·8 Fahr. from top to bottom. The greater part of this was in the upper 10 feet, the difference between 10 and 60 feet being only 1°, as shown in the following table:—

Surface	49°·9 Fahr.
10 feet	46°·1 „
20 „	45°·8 „
60 „	45°·1 „

Near shore the surface temperature was as high as 53°·4, the air temperature being 62°·2

The East Loch.—This is about half a mile distant from the west loch, and nearly 10 feet lower, about 1140 feet above the sea. It is 1¼ miles long, a quarter of a mile in greatest breadth, and averages just

under one-fifth of a mile in breadth. The maximum depth is 69 feet, and the mean depth 31 feet. It has an area of about 146 acres, or nearly a quarter of a square mile, and drains an area extending to about 9½ square miles, including that draining into the west loch. The volume of water is 191 millions of cubic feet, or less than half the volume of the west loch. The chief feeder is the stream from the west loch. There enters also at the upper end a branch of the Allt na Magha, the stream which has laid down the delta now separating the two lochs. About the middle of the east shore enters the small stream coming from Loch an Iubhair. The waters of Lochan na h-Earba are discharged by the Allt Lowrag, about a mile long, into Loch Laggan.

The east loch has the same general form as the west loch, long and narrow, broader at the upper end and tapering to the outflow. The deep water is all towards the upper end, the lower half of the loch being very shallow. The area enclosed by the 50-feet contour is about half the total length of the loch, and in this part the sections are somewhat U-shaped. A slight shoaling is observable opposite the entrance of the stream near the middle of the eastern shore, where, in the centre, the deepest sounding was 52 feet, with depths of 60 feet and over both to the north-east and south-west.

Temperature Observations.—Serial temperatures in the deepest part indicated practically the same range (5°) as in the west loch, and the distribution of temperature was exactly similar, but all parts of the loch were about 1° higher:—

Surface	51°·0	Fahr.
10 feet	47°·5	„
20 „	46°·2	„
50 „	46°·0	„

The air temperature was 55°·2.

Loch Laggan (see Plate III.).—Loch Laggan is situated in the southern portion of Inverness-shire, between the Highland and West Highland railways, being about equally distant from the nearest points of each. Dalwhinnie, on the Highland railway, is about 6½ miles from the upper end of the loch; Tulloch, on the West Highland railway, is about 6 miles from the lower end. The coach road from Kingussie to Tulloch passes along the northern shore. The loch runs nearly north-east and south-west, and occupies a valley lying between the very high mountains of Badenoch on the south-east and an equally high and more extensive mountain mass of the district of Lochaber on the west. The loch is of the usual elongate narrow form of Scottish lochs, narrowest in the central parts, and somewhat expanded towards each end, where deeper water occurs. The outline is very irregular, and the bottom, as shown by the contours, correspondingly irregular. A number of larger and smaller islands are found in the narrower parts of the loch. The

length is a little over 7 miles, the greatest breadth two-thirds of a mile, the mean breadth nearly half a mile, the superficial area about 1900 acres, or nearly 3 square miles. The maximum depth is 174 feet, the mean depth 68 feet, and the volume of water about 5600 millions of cubic feet. The loch was surveyed on June 2 and 3, 1902, when the elevation of the lake-surface above the sea was found by levelling from bench-marks to be 818·6 feet; the officers of the Ordnance Survey found the elevation to be 818·9 feet above sea-level on October 19, 1867. The

FIG. 4.—LOCH LAGGAN.

(*Photograph by Sir John Murray.*)

shores are wooded nearly throughout, and the scenery wild and picturesque (see Fig. 4), the mountains rising abruptly on the north side into a series of peaks, culminating in Creag Meaghaidh, 3700 feet high. On the south-east the high mountains are more distant, Beinn a' Chlachair, over 3500 feet, being 4 miles from the lower end of the loch. Close to the loch on this side, two hills, rather more than 2000 feet in height, separate it from the valley in which lies Lochan na h-Earba. Loch Laggan drains directly an area of 34 square miles, but since it receives

the overflow from Loch Pattack and Lochan na h-Earba, its total drainage area is nearly 62 square miles. The principal stream entering the loch is the river Pattack, which drains Loch Pattack and a number of smaller lochs. The Allt Lowrag brings the overflow of Lochan na h-Earba. Near Aberarder, in the middle of the north shore, two large burns enter, and there are many smaller streams on this side. The river Spean issues from the loch, and flows into the Lochy close to Loch Lochy.

Contours are drawn for every 25 feet of depth. The bottom is so irregular that only the 25-feet and the 50-feet contours are continuous, and follow approximately the outline of the shore. All the others are much broken up. The 75-feet contour is broken into four distinct portions; the largest of these approaches the west end of the loch, and is $2\frac{1}{3}$ miles in length. Two lesser areas, each about two-thirds of a mile in length, occur close together in the narrow middle part of the loch. The 75-feet area towards the upper end of the loch is nearly $1\frac{1}{2}$ miles in length. The shallowings between these various basins are all opposite the mouths of streams, but in one instance the stream is too small to account for the shallowing, and other larger streams appear to have had no effect on the contours. The largest 75-feet basin includes two areas of over 100 feet, a very limited one in the narrow part of the loch, with a maximum depth of 105 feet, and another, $1\frac{1}{2}$ miles in length, near the west end. This 100-feet area is at the broadest and deepest part of the lake, and includes an area, two-thirds of a mile in length, of over 150 feet, in which two soundings of 174 feet and 170 feet respectively were taken, with a shallowing of 155 feet between them. The two small 75-feet areas near the middle of the lake include depths of 112 and 114 feet respectively. The easternmost 75-feet area includes two very small basins of over 125 feet, with maxima of 133 and 141 feet. Many lesser irregularities occur. For about half a mile from the inflow of the river Pattack the loch is very shallow, and the bottom and shores are sandy.

The approximate areas between the contour-lines at intervals of 50 feet, with the percentages to the total area of the loch, are given in the following table:—

Feet.		Acres.		Per cent.
0 to 50	... ...	765	...	40·3
50 „ 100	... ...	686	...	36·1
100 „ 150	... ...	396	...	20·8
Over 150	... ...	53	...	2·8
		1900		100·0

Temperature Observations.—The following series of temperatures, taken towards the east end of the loch at noon on June 3, 1902, indicates a range of only 1°·2 Fahr., the greater part of the variation occurring in the upper 10 feet of water:—

Surface	...	47°·0 Fahr.
5 feet	...	46°·6 „
10 „	...	46°·2 „
20 „	...	46°·0 „
30 „	...	45°·9 „
50 „	...	45°·9 „
70 „	...	45°·8 „
100 „	...	45°·8 „

Loch Ossian (see Plate IV.).—Loch Ossian (or Ouchan) is a narrow loch in a valley running nearly north-east and south-west to the north of Rannoch moor (see Fig. 5). It lies at a considerable elevation, about a mile north-east of the summit of the West Highland railway, at Corrour station, from which the loch can be seen. The mountains rise to over 3000 feet both on the north-west and south-east. The former solitude is now relieved, since the mansion of Sir John Stirling Maxwell, Bart., has been built on the shore of the loch.

In form Loch Ossian is narrow, with its long axis slightly curved, and of nearly uniform breadth throughout. It is 3¼ miles long, nearly half a mile in greatest breadth, and has a mean breadth of about one-third of a mile. The greatest depth is 132 feet, and the mean depth 43 feet. It has a superficial area of just about a square mile, and a volume of 1224 millions of cubic feet. It drains an area of nearly 10½ square miles, receiving only mountain torrents from the surrounding hills, and flows out by the river Ossian into Loch Ghuilbinn, 2½ miles to the north. The loch was surveyed on May 14, 15, and 16, 1902, when the height of the water above sea-level was found to be 1268·7 feet; this is nearly identical with the level determined by the Ordnance Survey officers on May 27, 1870, viz. 1268·6 feet.

The bottom of Loch Ossian is very uneven, the transverse, as well as longitudinal, sections being undulate. Only the 25-feet contour follows the line of the shore. The 50-feet contour encloses an area 2 miles in length. The south-western portion of this for three-quarters of a mile is exceedingly narrow. Near the middle of the loch it broadens to a quarter of a mile, and continues broad to near the outflow. The area over 75 feet in depth is fully a mile in length, that over 100 feet half a mile, and that over 125 feet a quarter of a mile in length. One mile from the upper end there is in the centre of the loch a shoal, over which the depth is only 11 feet. The approximate areas between the contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	214	32·6
25 „ 50	234	35·6
50 „ 75	104	15·8
75 „ 100	72	10·9
Over 100	33	5·1
	657	100·0

It will be observed that the area of the lake-floor covered by water between 25 and 50 feet in depth is larger than the shore-zone covered by less than 25 feet of water.

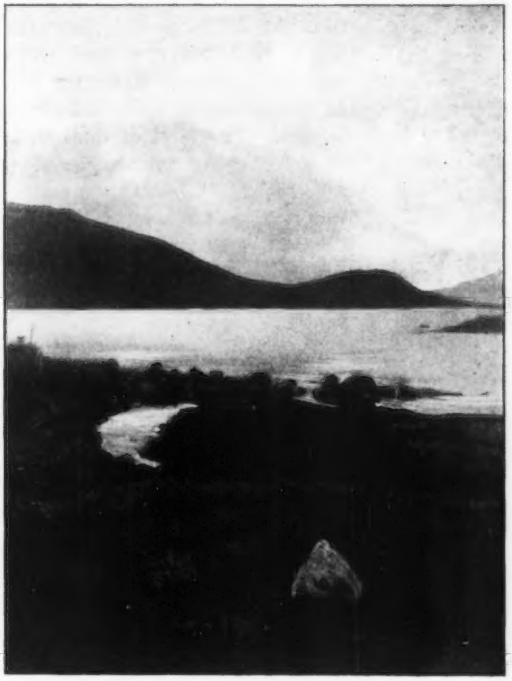


FIG. 5.—LOCH OSSIAN.

(*Photograph by Sir John Murray.*)

Temperature Observations.—The following temperatures taken at 1 p.m. on May 16, 1902, shows a range of less than 1° Fahr.:—

Surface	...	...	...	...	...	...	...	44°·3 Fahr.
10 feet	...	...	...	...	...	...	...	44°·1 „
25 „	...	...	...	...	...	...	...	43°·7 „
50 „	...	...	...	...	...	...	...	43°·8 „
100 „	...	...	...	...	...	...	...	43°·4 „

Loch Ghuilbinn (see Plate V.).—Loch Ghuilbinn (or Gulbin) is a small and relatively broad loch, lying in the midst of the high mountainous region between Lochs Ericht, Treig, and Laggan. The long axis runs nearly north and south. The surrounding hills rise on all sides into peaks of well over 3000 feet. The loch is fully three-quarters of a mile

long, and nearly half a mile in greatest breadth, with a mean breadth of a little over a quarter of a mile. The greatest depth is 49 feet, and the mean depth over 13 feet. The superficial area is about 146 acres, or nearly a quarter of a square mile, and the volume 85 million cubic feet. It receives the drainage of a basin extending to 29 square miles, including Loch Ossian. It is fed chiefly by the river Ossian, which, besides bringing the overflow of Loch Ossian, receives the drainage of considerable glens both to the east and west. Its outflow is by the river Ghuilbinn, which flows due north about 5 miles and enters the river Spean just below Loch Laggan. The level of the loch is estimated from spot-levels on the shore to be 1160 feet above the sea.

Loch Ghuilbinn is a simple basin. The sides slope very gently down to 20 feet, nearly 86 per cent. of the whole area of the loch being less than 20 feet in depth. From 20 to 40 feet the slope of the sides is much steeper. A very small area exceeds 40 feet in depth, only about $3\frac{1}{2}$ per cent. of the whole. The surface temperature on May 17, 1902, varied from 45°·0 to 45°·3 Fahr.

Loch Treig (see Plate VI.).—Loch Treig occupies a deep narrow valley among very high mountains in the region of Lochabar (see Fig. 6). The valley trends nearly due north and south. The West Highland railway runs along the east side, and Tulloch station, whence the coach road goes off towards Kingussie, is only 2 miles from the north or lower end of the loch. There is no road on either side of the loch, nor is there to the south any public road nearer than Kingshouse, at the head of Glencoe, Rannoch station being about equally distant. The old road from Struan to the old Corrour Lodge came to the head of the loch, but is now disused and in bad condition. A cart-road approaches the north end of the loch. The sides of the loch are quite uninhabited, but at or near either end are a few keepers' houses and farms. The mountains rise very steeply on either side, those on the west being higher, rising in a series of peaks, the highest of which (Stob Choire an Easain Mhoir) reaches a height of 3658 feet; on the east the highest peak is Cnoc Dearg, 3433 feet high.

The length is a little over 5 miles, the greatest breadth three-quarters of a mile, mean breadth just under half a mile. The maximum depth is 436 feet, the mean depth 207 feet. The area of the loch is nearly $2\frac{1}{2}$ square miles, and it drains an area of about 42 square miles. Three streams, considerable only during floods, enter the upper end of the loch; the sides are unbroken by any large stream, but are scored by the torrents which cut through the glacial *debris*, which here, as at Loch Lochy, extends far up the hillsides. The overflow is carried by the short river Treig into the river Spean at Tulloch. On May 29, 1902, when the survey was finished, Loch Treig was 787·0 feet above sea-level; the level was high in consequence of recent rains. On

July 13, 1868, the Ordnance Survey found the height above the sea to be 783·9 feet. In volume Loch Treig comes third among the lochs of the Lochy basin, containing 13,907 millions of cubic feet. This is more than twice the volume of Loch Laggan, rather more than half that of Loch Arkaig, and one-third that of Loch Lochy.

In form Loch Treig is a narrow triangle, broadest towards the south end, and tapering all the way to the outflow. Half a mile from the north end a rocky promontory, the Rudha Ceann Ard Thonnaich, constricts the loch, but there is no shallowing in the narrows, where the depth is

FIG. 6.—LOCH TREIG.

(Photograph by Dr. T. N. Johnston.)

well over 200 feet. The basin is quite simple, all the contours approximately following the shore-line. The steep slope of the hills is continued under water, and there is in most parts but little beach. The axis of the loch is slightly curved, and the line of greatest depth is nearer the west shore. The area over 400 feet deep is very narrow, about 2 miles in length, and at both ends comes very close to the west side, the steepest slopes in the loch being at these points. The cross-sections in the middle parts of the loch, as at C–D on the map, only show slightly the U-shape which distinguishes glacier-hollowed lochs. The valley is so narrow, relatively to the depth of the loch, that the steep slopes reach far towards the middle, and leave but little comparatively level bottom. Towards the south end, where the loch is broader,

and the depth less (from 200 to a little over 300 feet), there is a greater extent of nearly flat bottom, and the U-section is more clearly marked. The approximate areas between the consecutive contours at intervals of 100 feet, and the percentages to the total area of the loch, are given in the following table :—

Feet.	Acres.	Per cent.
0 to 100	415 ...	27·0
100 „ 200	294 ...	19·1
200 „ 300	440 ...	28·6
300 „ 400	256 ...	16·6
Over 400	135 ...	8·7
	1540	100·0

The striking characteristic brought out by this table is the large area of the lake-floor covered by water between 200 and 300 feet in depth—an area greater than in either of the two shallower zones.

Temperature Observations.—At the early season when Loch Treig was surveyed, the surface was very little warmer than the bottom, the whole difference between the surface and 300 feet, on May 29 when the last series was taken, being only 1°·7 Fahr. Four days earlier, May 24, the difference was only 0°·7. In the interval the surface had risen in temperature 1°·6, while at 300 feet the rise was only 0°·6. The three serials are contrasted in the table appended :—

	May 24, 11.30 a.m.	May 27, 9 a.m.	May 29.
	° Fahr.	° Fahr.	° Fahr.
Surface	41·2	41·6	42·8
5 feet ...	41·2	—	—
10 „	41·0	41·2	—
20 „	41·0	41·7	—
30 „	41·0	—	—
40 „	—	41·4	—
50 „	41·0	—	42·0
100 „	40·9	—	41·8
150 „	40·8	—	—
200 „	40·8	—	41·2
250 „	40·6	—	—
300 „	40·5	—	41·1

An Dubh Lochan (see Plate VII.).—A very small loch situated about halfway between Loch Treig and the river Spean and a little to the west of the river Treig. It lies at an elevation of 785 to 790 feet above the sea, at the west side of an extensive deposit of gravel and sand, hills of moderate height rising on the west shore (see Fig. 7). It is of somewhat oblong form, diversified by many little bays, and is shallow and weedy towards the south end. It is nearly a quarter of a mile long, and covers an area of about 8½ acres. The greatest depth is 40 feet, and the mean depth 15½ feet. The volume of water amounts to 6 millions of cubic feet. It has a drainage area of

about one-sixth of a square mile, receiving only local superficial water. It drains by a small stream northward into the river Spean.

The basin of the loch is quite simple, the deepest part being much nearer the north end, and the longitudinal slope is accordingly quicker at the north end and very gradual towards the south. The temperature

FIG. 7.—AN DUBH LOCHAN.
(*Photograph by Colonel Mainwaring.*)

of the water on October 18, 1904, was 46°·0 Fahr. at the surface, the same at a depth of 20 feet, and only a trifling fraction less at the bottom, 45°·8.

Lochan Lùnn dà-Bhrà (see Plate VIII.).—A very picturesque loch, almost halfway between Fort William and Ballachulish. It is about 5 miles south of Fort William, and is reached by a very rough road, one of General Wade's military roads. It is a narrow loch, with its axis running north-east and south-west. The surrounding hills are of moderate height (1500 to 2000 feet) and grassy, except on the east, where Mullach nan Coirean rises steeply to 3000 feet. Patches of fir wood towards the lower end of the loch enhance the beauty of the scene.

The loch is nearly a mile long and relatively very narrow, the greatest breadth being only about one-sixth of a mile, and the mean breadth one-eighth of a mile. The maximum depth is 25 feet, and the mean depth 8½ feet. The surface has an area of about 66 acres. The volume of water is 23 millions of cubic feet. It receives the drainage

from an area of over a square mile, by small burns only, and flows out by the Water of Kiachnish into Loch Linnhe.

At the date when surveyed (May 9, 1903) the height above sea-level was 510·1 feet, exactly one foot lower than the elevation determined by the Ordnance Survey officers in May, 1867.

The basin of Lochan Lùnn dà-Bhrà is broken by islands, about a quarter of a mile from each end, and nearly in the middle of the loch. The island towards the upper end is on a bar, the greatest depth to the north-west and south-east of it being respectively 9 and 8 feet. This bar cuts off a separate small basin, with a maximum depth of 21 feet. The greatest depth of the loch, 25 feet, was found not far to the north-east of this island. North-east from the lower island it is everywhere shallow, nowhere exceeding 7 feet.

The shores of Lochan Lùnn dà-Bhrà are composed chiefly of gravel with boulders, which form many heather-covered mounds. Rock is exposed in many small spots. The stream flows out through a flattish tract, covered with moraine mounds, about half a mile long, and rock was seen in the channel at a distance of about 100 feet from the loch. The promontory below Lundavra farm has been laid down by the stream.

We were told by the local inhabitants that the loch will sometimes freeze all over in a single night, and that small dark trout are abundant in it. There are also some pink-coloured trout, and others silvery like salmon.

The temperature was 48°·0 Fahr. throughout.

Loch nan Gabhar (see Plate VIII.).—Loch nan Gabhar (or Gour) is a little weedy hollow lying close to the sea-shore, and very little above sea-level, on the west side of Loch Linnhe, nearly opposite Ballachulish. It runs nearly east and west, and occupies the southern portion of a large oval alluvial flat, in the midst of which rises an abrupt boss of rock, the Tòrr an Duin, apparently some 70 or 80 feet in height. This alluvial flat is surrounded by steep rocky hills, which form the southern shore of the loch.

The loch is of very irregular form, and interrupted by narrows, bays, and promontories. It is fully half a mile long, one-sixth of a mile in greatest breadth, and one-eighth of a mile in mean breadth. The maximum depth is 5 feet, and the mean depth 2½ feet. The area of the water-surface is only about 45 acres, and it receives the drainage of 13 square miles of country. The height above sea-level, on the date when the survey was made (May 12, 1903), was 7·35 feet, as compared with 7·5 feet observed by the officers of the Ordnance Survey on July 19, 1867.

Loch nan Gabhar receives by the river Gour the drainage of a considerable mountainous stretch of country, bordering Glen Gour,

which extends 5 miles west from the loch, among peaks rising to nearly 2500 feet. Two branch glens extend several miles to the north, and one of these brings the overflow of a small loch, Lochan na Beinne Baine, which was not surveyed. As a consequence of the extensive drainage area, the loch is subject to great alterations of level. The river has laid down long spits of sand, and threatens to silt up the loch altogether. A very short stream conveys the overflow to the sea; there is a boss of rock on the north side where it leaves the loch. In volume Loch nan Gabhar is the last in the basin, containing only 5 millions of cubic feet, or one million less than the volume of an Dubh Lochan.

The temperature of the water on May 12, 1903, was 51°·5 Fahr. at the surface and at the depth of 5 feet.

The particulars regarding the lochs dealt with in this paper are collected together in the table on the following page for convenience of reference and comparison.

From this table it will be seen that in the twelve lochs under consideration, which cover an area of about 20 square miles, nearly 2600 soundings were taken, or an average of 214 soundings per loch, and an average of 129 soundings per square mile of surface. The aggregate volume of water contained in the lochs is estimated at 85,855 millions of cubic feet, or more than one-half of a cubic mile, and the area draining into them is over 270 square miles, or nearly fourteen times the area of the lochs.

The Red Lochan at Tulloch.—The Red Lochan, called in Gaelic by a name which signifies "brown eye," is a very small pond lying in an extensive morainic terrace at Fersit, near the north end of Loch Treig. It is only about 30 yards in its longest diameter, and 5 feet deep in the centre, is fed only by rains, and has no outflow except by percolation through the gravel, yet its surface is maintained almost constantly at the same level. The water is always turbid, and varies in colour from dull green to brown or red.

It was first examined by Sir John Murray in May, 1902. The water was then brown; the collection taken with the coarse net very pale yellow, that taken with the fine net a decided red. At that time there were only two very abundant organisms—the larva of an insect, *Corethra*, known as the "phantom larva," and a reddish-coloured rotifer, *Anuræa valga*. There were many other rotifera, entomostraca, and other organisms common in ponds, but none of these were abundant enough to be held responsible for the colour of the water. The collection made with the fine net was examined by Dr. T. N. Johnston and James Murray. On adding a little formalin, which killed the animals, a blood-red sediment was deposited, which was found to consist chiefly

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Lochy	94·24	527	9·78	1·26	0·60	6·1	531	228·95	43·1	97	226	37,726	5·91	123·76	20·9
Arkaig	139·00	667	12·00	0·87	0·52	4·3	359	152·71	42·5	176	415	26,573	6·24	66·03	14·2
Pattack	[1419 approx.]	78	1·03	0·48	0·26	25·5	58	14·07	24·3	94	386	106	0·27	18·18	67·3
Lochan na h-Earba (west)	[1151·7 Apr. 1873]	90	1·80	0·30	0·23	12·8	81	35·62	43·9	117	267	408	0·41	5·26	12·8
Ditto (east) ...	[1142·3 Apr. 1873]	81	1·27	0·26	0·18	14·2	69	31·11	45·1	97	21 6	191	0·23	4·27	18·5
Laggan	818·6	513	7·04	0·66	0·42	6·0	174	67·68	38·9	214	549	5,601	2·97	61·86	20·8
Ossian	1268·7	176	3·20	0·45	0·32	10·0	132	42·75	32·4	128	395	1,224	1·03	10·36	10·0
Ghuilbinn	[1160 approx.]	59	0·82	0·40	0·28	34·2	49	13·32	27·2	88	325	85	0·23	29·13	91·3
Treig	787·0	253	5·10	0·75	0·47	9·2	436	207·37	47·6	62	130	13,907	2·41	42·32	17·5
an Dubh Lochan ...	[785 to 790]	31	0·24	0·08	0·06	23·1	40	15·50	38·8	32	82	6	0·01	0·16	16·0
Lùnn dà-Bhrà ...	510·1	52	0·86	0·16	0·12	13·8	25	8·44	33 7	182	538	23	0·10	1·13	11·3
nan Gabhar	7·35	43	0·58	0·16	0·12	21·0	5	2·50	50·0	612	1125	5	0·07	12·82	18·3
		2570										85,855	19·88	271·18 *	13·6

* The drainage area of Loch Arkaig is included in that of Loch Lochy; those of Loch Pattack and Lochan na h-Earba in that of Loch Laggan; and that of Loch Ossian in that of Loch Ghuilbinn.

of *A. valga* and myriads of its red eggs. At that time this species seemed to be mainly the cause of the red colour.

Examined at different seasons, the colour was found to vary. In October, 1903, it was very red; in May, 1904, dull brown; in January, 1905, green. On all these occasions the phantom larva was about equally abundant, and none was seen in a more advanced stage of development. The changes of colour are doubtless correlated with the predominance of one or another organism. The *A. valga* is not always red; in May, 1903, it was dull grey in colour. When algæ are swarming, the colour will incline to green. The colour may be affected by the development of certain entomostraca — *Diaptomus gracilis*, for instance, was very abundant, but quite colourless, in May, 1903. Later in the year it becomes brown or red.

There are other ponds in close proximity to the Red Lochan, but none of these shares the turbidity and reddish-brown colour. The peculiarity is probably due to its being more closely shut in. The surrounding rim of gravel is 14 feet above the pond at its lowest part. There is, besides, a fringe of birch trees. The water is stagnant, which favours the growth of certain organisms, particularly *Anuræa valga*. The blood-red larva of *Chironomus*, though abundant, could have no part in causing the red colour, as it was not in the open water, but among the weeds and mud.

Mr. Robertson, the keeper at Fersit, to whom we are indebted for several collections and much information about the loch, states that it is later in freezing than the other ponds in the region. The more active decomposition in the stagnant water would account for this.

The temperature of the water in May is about 45°·0 Fahr. It is said that wildfowl never settle on this pond, and that the common frog cannot live in it.

The following legend was related to Sir John Murray concerning this Red loch :—

"Many centuries ago there lived in these parts a noted hunter named Donnuil. In return for some services rendered to the witch of Ben-a-Vreich, she offered to deprive the deer either of the sense of sight or of smell, so far as he was personally concerned. He chose to have the deer deprived of the sense of smell, 'for,' said he, 'I can easily cheat their eye.' The witch, however, told him that in the stomach of the last stag he would kill there would be found a ball of worsted thread. As time passed Donnuil became ill, and, while weak in bed, his daughter told him a fine stag was caught by the horns in some bushes near the house. He asked for his cross-bow, and, although in bed, he shot the stag through his bedroom window. Later on his daughter brought him a ball of worsted which had been found in the stomach of the stag. He knew his end was near; indeed, he died the same evening. On the following morning the Red Lochan had appeared at the place where the stag was killed."

This story was evidently invented to explain the origin of the Red loch, and is of the same order as those stories invented to explain why the fox has a bushy tail, and why the serpent crawls on his belly.

NOTES ON THE BIOLOGY OF THE LOCHS IN THE LOCHY DISTRICT.

By JAMES MURRAY.

There is little peculiarity in the biology of the large lakes in the basin, except in that of Loch Lochy. They contain the ordinary fauna of great lakes of low temperature. Most of them were surveyed so early in the season that the water was little above the minimum winter temperature, and the summer crustacea (*Holopedium*, *Leptodora*, etc.) had not arrived. The smaller lochs were warmer, and some of those crustacea were present.

Loch Arkaig.—The plankton is almost exactly that typical of large lakes, with hardly any local peculiarity. The larva of *Leptodora*, which we have rarely found, was present. A few examples of the somewhat rare *Latona setifera* were found. A few species of plankton-desmids, chiefly of the genus *Staurastrum*, occurred, but they were less conspicuous than in the lochs farther west.

Loch Lochy.—Though the situation of Loch Lochy is so similar to that of Loch Ness, and though the depth in the two lochs is comparable, the plankton of Loch Lochy offers a remarkable contrast to that of Loch Ness. In two different years when the lochs were examined, the plankton in Loch Lochy was found to be much richer. The quantity was many times greater, the species more numerous, but the special feature was the quantity and variety of the phytoplankton. This will be treated in detail later by Prof. Bachmann. Diatoms were very abundant. *Tabellaria fenestrata*, var. *asterionelloides*, was of more luxuriant growth than had been observed elsewhere, the colonies often making more than two complete turns of the spiral. The rare crustacean *Ophryoxus gracilis* (discovered in Britain in Loch Ness by Mr. D. J. Scourfield) was present. The heliozoon *Clathrulina*, of frequent occurrence in our larger lakes, but usually as skeletons merely, was here abundant and alive, the majority of the examples having the pseudopodia fully extended.

Lochan na h-Earba.—The fauna calls for little comment. *Latona setifera* was found in the west loch. Of the summer crustacea, *Holopedium* was in both lochs, *Leptodora* only in the east loch, and *Diaphanosoma brachyurum* only in the west loch. Desmids were conspicuous in both lochs, and included some species which we have not often found.

Loch Laggan.—The plankton is quite ordinary, except that it is the only loch of the basin where we observed two species of *Diaptomus*. One was the common *D. gracilis*, the other difficult to determine, owing to the lack of fully matured examples, but almost certainly *D. laticeps*.

Loch Ossian and Loch Ghuilbinn.—The fauna of these lochs is in no way peculiar. Desmids were scarce in Loch Ossian, and abundant in Loch Ghuilbinn, where, among others, *Staurastrum ophiura* occurred.

Loch Treig.—*Bosmina obtusirostris* had a very long spine, approaching the variety *longispina*, as found in Loch Morar. This is the only large lake where we found the rotifer *Triarthra longiseta*. Skeletons of *Clathrulina* were abundant. The phytoplankton was fairly rich in species, and about a dozen Desmids were noted.

An Dubh Lochan.—This was examined very late in the season. The chief peculiarity noted was the red colour of the *Diaptomus*, a feature found in more marked degree in Lochan Lùnn dà-Bhrà. Desmids were abundant, and the two fine species, *Staurastrum braziliense* and *S. longispinum* occurred.

Lochan Lùnn dà-Bhrà.—The *Diaptomus* in this loch was so deep red that when the nets were taken out after towing, they seemed to contain blood.

Loch nan Gabhar.—From its shallow weedy character an abundant fauna would be expected here, yet we found the collections exceptionally poor.

CORRECTION.—*King Eider Duck.*

In our paper on the "Lochs of the Tay Basin," Part III., which appeared in the *Journal* for January, 1904 (vol. **23**, p. 40), the following sentence occurs: "The king eider is said to have bred in the White Loch for some years, and to have successfully reared its young." This is evidently an error, and I am sorry the sentence should have escaped my notice in reading the proof of the paper. The statement was entered in the note-book of one of the assistants of the Survey on the authority of one of the neighbouring proprietors of the district, familiar with the ornithology of the White loch. I am not able to state what bird was taken for the king eider.—JOHN MURRAY.

THE VOLCANO OF SMEROE, JAVA.

By I. A. STIGAND, B.A., F.G.S.

THE Smeroe, the highest peak and most persistently active volcano in Java, is situated in a wild and uninhabited district of East Java, and its cone has raised itself on the southern edge of an elevated and extensive system of ancient craters. As viewed from a distance, it appears as a lofty grey cone, upraised above the surrounding mountains, and from time to time—at intervals of from one minute to half an hour—a steam-cloud of globular structure is discharged from the crater, which, gradually detaching itself from the mountain, is borne away towards the leeward horizon. The form of these outbursts is variable; sometimes all the materials blown out by the steam fall in the vicinity of the crater, sometimes blocks of all sizes are scattered over the mountain. There are also times when the volcano is in a state of violent activity, *e.g.* in the year 1885 there was a great eruption.

The ascent of the mountain can either be made from Malang, to the north-west, or from one of the resorts situated on the Tengger mountain —above Passœroean, to the south. In the latter case, a descent to the plains is not necessary, but the route keeps on a high level across the system of ancient craters.

I will not dwell on the Tengger and the well-known "sand sea," enclosed by the ring of hills forming its crater, and enclosing the volcano of the Bromo with the extinct volcanoes of the Widodaron and Battaq,

but, since these lie on the route to the Smeroe, a short description may not be out of place.

The Tengger mountain is an ancient volcano of prodigious size, which must have formerly reached a height of, perhaps, 15,000 feet. To-day the summit consists of a vast crater-ring whose maximum diameter has a length of about 4 miles, the crowning peak of the encircling hills—the Penandjahan—rising to an altitude of 9035 feet. The interior of this great ring consists of a vast plain of sand and volcanic dust, with some blocks which have been discharged at the times when the Bromo has been more than usually active.*

In the midst of this great ring, and slightly to the east, is situated

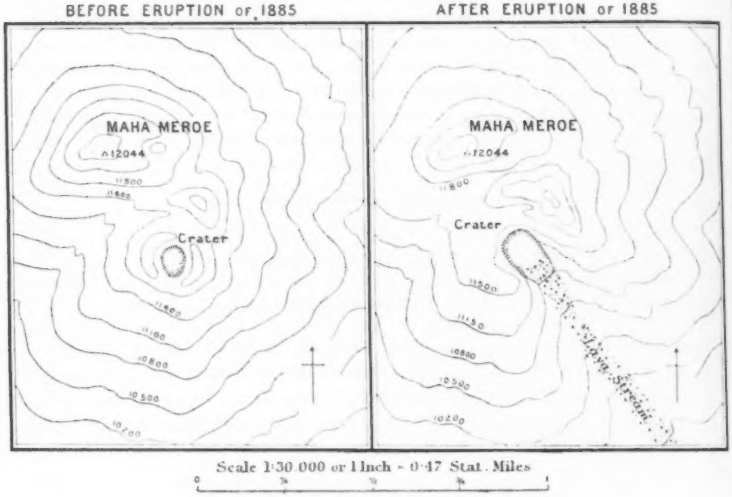


FIG. 1 THE SUMMIT OF SMEROE

The contours are only approximate

the perfectly formed tuff-cone of the Battaq, which is now extinct, and rises to nearly 1000 feet above the level of the sand-sea. To the south of the Battaq, and continuous with the great crater-ring of the Tengger, is situated the extinct volcano and craters of the Widodaren (*i.e.* Phantom), which include the craters called the Segara Kedi Kidoel (South sea), and the Segara Kedi Lor (North sea). The former, which is to the south-west, has an elongated shape, and is situated at a high altitude. The highest point of the crater ring—the summit of the

* It has been suggested by Dr. Verbeek that the ancient Tengger volcano had originally two principal centres of eruption, about 2 miles apart, in 'Geologische Beschrijving van Java en Madoera' ('Verbeek en Fennema'), vol. i. § 2, II.

Widodaren—attains an altitude not much below that of the Penandjahan, the culminating point of the whole Tengger. The Segara Kedi Lor is situated on the north-east of the Widodaren, and is a large circular crater, similar in form to that of the Bromo, the bottom being at the level of the sand-sea, and the sides only rising about 500 feet. The bottom is comparatively level, and consists of dark sand with loose blocks of lava. Adjoining this on the north-east, and overlapping it, is situated the active crater of the Bromo.

The Bromo.—This volcano is composed of a low tuff cone, proportionately, of very great diameter, the sides only rising a few hundred

FIG. 2.—DISTANT VIEW OF THE SMEROE FROM THE PENANDJAHAN (9035 FEET), WITH THE "SAND SEA," CONTAINING THE BATTAQ AND BROMO, IMMEDIATELY IN FRONT, WHILE THE MOUNTAIN BETWEEN THE LATTER AND THE SMEROE IS THE AJEK AJEK.

feet above the surface of the sand-sea, while the bottom of the crater is slightly below the level of the sand-sea. The cone is composed of fine volcanic sand and solidified mud with blocks of lava. The volcano is usually only in a state of solfatarous activity, but there are also times when the activity is of a more violent nature, and immense volumes of steam rise up, carrying lapilli and the blocks which can be observed strewn on the cone and even on the sand-sea itself. On the bottom of the crater and around the lower part of the sides there are a number of fissures and holes, from which steam escapes in the form of jets with a hissing sound. These are continuous and not spasmodic, as is the case with the steam issuing from volcanic vents of greater activity. The

fissures and holes, and indeed a considerable part of the bottom of the crater, are coated with sulphur, which is precipitated, doubtless, by the chemical action of the gases, sulphur dioxide and sulphuretted hydrogen, which issue from the vents, thus—

$$2H_2S + SO_2 = 2H_2O + 3S$$ *

At times the fumes of sulphur dioxide are suffocating at the edge of the crater. The bottom of the crater and sides are coated also with other precipitations or sublimations of white and pale yellow colours, much of which is probably due to chlorides and sulphates of iron. Numerous blocks that lie scattered about the cone and sides of the crater are thus coated. At the bottom of the crater a system of cracks may be observed through the deposits, resembling gigantic mud-cracks.

The normal activity of the Bromo is not of a very imposing nature; a number of fumeroles, or small steam-jets, which are more numerous at the lower part of the sides of the crater than at the bottom, issuing from fissures and holes which are coated with sulphur, together with the presence of other deposits abundant at the bottom and sides of the crater, constitute the usual phenomena of activity of this volcano. Were it not for the occasional eruptions referred to above, this volcano could only be denoted a solfatara. If, however, we visit the volcano at night-time, a much more imposing spectacle is witnessed, and the close proximity of molten lava is revealed by the ruddy glow coming through the various fissures and holes from the molten lava beneath. The lava of the Bromo is a dark pyroxene andesite on the verge of the basalts. Dr. Verbeek considers that it has sufficient olivine to rank among the basalts.

To the north-west of the Bromo, and, at the base, overlapped by its newer materials, is situated the Battaq, the only one of the series of newer volcanoes which have risen up within the great ancient crater of the Tengger—the sand-sea, which remains to be observed.

This is a perfectly formed tuff cone, rising about 900 to 1000 feet above the sand-sea, with steep sides, and the beautifully curved outlines typical of such cones. It is almost wholly composed of tuff, but on the east side, at a considerable altitude, there has been an ancient flow of lava, which is exposed in the gullies. This lava is a red-coloured basalt with plagioclase crystals, the colour being due to the decomposition of its ferruginous ingredients.

A series of gullies has been carved out by water all round the cone, and these gullies gradually deepen as they approach the base of the cone. By the regularity of these gullies, which start from the very top of the cone and run straight down, the formation of this mountain must have been very rapid. The crater at the top has been, to a large extent,

* Another reaction—$2SO_2 + H_2S = H_2SO_4 + 2S$—may also take place, resulting in the production of sulphuric acid (as well as sulphur), which, combining with the iron, etc., contained in the surrounding rocks, would form sulphates.

obliterated by deep watercourses, which start from the low crater ring on the north-west side, and run towards an outlet on the south-east side; but the crater must always have been a shallow one.

As formerly observed by Jukes, these extinct volcanoes of the Tengger give a remarkable exhibition of different stages in the sculpture of volcanoes.

On the occasion that we made the excursion to the Smeroe, having left the hotel at 3 a.m., we reached the edge of the sand-sea at the Moenggal pass just at daybreak. Looking down on the sand-sea, we saw that the arena was carpeted with white clouds, a curious phenomenon, not unusual in the early morning. Having descended to the sand-sea, we crossed over the plain to a pass on the opposite side of the ring.

From the top of the pass there is a good view of the Smeroe, which then appeared to be belching forth steam clouds with unusual vehemence and rapidity. After skirting for a considerable distance the southern part of the ring of the Tengger, the track descends through bush and long grass, which reaches almost as high as the ponies. The path here enters a wilder district to a plateau, containing three small lakes at the intersection of the Tengger and Ajek Ajek, formed by the overlapping of the materials accumulated by these two ancient volcanoes.

A halt is convenient at one of these lakes, which can be reached in about three hours from the southern part of the Tengger. Beyond the lake the track again threads through bush and tall grass, concealing numerous pitfalls, and then begins to mount along a narrow spur of the Ajek Ajek. The track unnecessarily crosses the highest point of the mountain, and the ascent is long and tedious, through thick grass, which almost completely envelops the ponies, and which is interspersed with tjemara trees and bush.

After some while the culminating point of the Ajek Ajek (9162 feet) is reached, but the bush and trees tend to hide a magnificent view. The Tengger is situated to the north, while to the south and south-west are the mountains belonging to the remnants of a gigantic ancient crater ring, situated between the Tengger and Smeroe, of which the Ajek Ajek itself is the northern portion. The western half only of this ring remains, consisting of a semicircular range of mountains, stretching from the Ajek Ajek on the north to a mountain called the Kepala, situated to the south and in front of the Smeroe. Also there are several newer volcanic peaks which have risen up within this crater; the Kepala (9864 feet) has also been a separate centre of later eruption, consisting of basaltic rocks; the rocks of the Ajek Ajek belong to the pyroxene andesites. The panorama includes the Kloet and Kawe, etc., on the other side of the plain of Malang, on the west; also, on the north-east a distant view of Probolinggo; while the peak of the Smeroe lies behind the Kepala to the south.

The track, if it may be called even this, now descends in zigzags the precipitous south side of the Ajek Ajek, which is, of course, the inner wall of the great crater ring above mentioned. The descent has to be made on foot; here, too, the route is through the long leaf grass, interspersed with tjemara trees.

Ajutting from this side of the Ajek Ajek is a later volcanic cone, and the route descends to the pass between this and the Ajek Ajek; then, turning westward, it descends to a portion of the old crater plain below, which now presents the appearance of a valley, of which the northern and western side is bounded by the Ajek Ajek and the ancient crater ring, while the newer volcanic peak, referred to above, shuts in the valley on the east. Other newer volcanic peaks are situated to the south and east, which, overlapping, form one massif.

The route traverses the length of the valley, at the end of which a small crater lake * is reached. This is surrounded completely by hills, but with a large mound on the north side, over which the lake is approached. If an early start is made from the Tengger, the lake can be reached in an hour or two before sunset, and is a convenient place to pass the night, there being a suitable place for a camp at the western side of the lake. The base of the actual peak of the Smeroe is about five hours distant.

After an uncomfortable and unrestful night here, which was bitterly cold—the altitude of the lake being not far short of 8000 feet—we started for the Smeroe on the following morning. There was hoar-frost on the grass until about 8 a.m. The route, after ascending out of the hollow in which is situated the lake, follows along a grassy valley, and at length ascends slantwise the northern slopes of the Kepala to a pass in the mountains. The route along the Kepala is through very thick and long jungle grass and a forest of tjemara trees. The track is obscure, being frequently not recognizable, and over rough country; but the trees were blazed in some places to point out the route. At the top one finds one's self in an open grassy place, which gradually slopes down to the Smeroe, and there a magnificent view of the Smeroe, which is quite close, opens out. Fig. 3 was taken from this point at the time when the mountain was blowing. The view is taken from the north side of the mountain, being the side on which the ascent is made. The crater lies at the other side, just below another point on the south side, which is not quite so high as the Mahameroe, the latter being the summit seen in the photograph. From here the route descends to the hollow lying between this pass and the Smeroe, and the descent is not very long. At the bottom of the hollow there is a lot of *débris*, deposited by the torrents descending from the mountain, and on the north side there is a low cliff of old red lava much decomposed. The first half of the ascent is up steep slopes through forests of tjemara trees. After

* Named "Kembolo."

FIG. 3.—THE SMEROE FROM A POSITION IN THE VICINITY.

ascending for about one hour and a half, a place is reached where two small idols are situated, which the natives worship, and where, placing food before them, ostensibly for sacrifice, they elicit favour of the god of the volcano, and for the ascent; and some time was spent by them in thus invoking the gods in the form of these idols.

At not a long distance above this joss-place the woods cease, and there is no more vegetation on the bare cone. A first look up the grey slopes of sand and coarser ejectamenta does not give a correct impression of distance to the top. When, however, the comparatively slow progress up the mountain is observed, the great height is realized. The progress is the more slow on account of the looseness of the sand, which makes one slide back and sink in to a considerable extent at each footstep, and in some places it is very steep and somewhat difficult to gain a foothold. The ascent over these loose materials occupies about two and a half hours. As the summit is approached the slope gets steeper, the sides forming the curves typical of volcanic ejectamenta cones, thus becoming more precarious.

Not far from the summit the route crosses a narrow ridge formed of loose fragments in a crumbling condition, which descends steeply on either side, and then a gentle slope is traversed, and the summit of the Mahameroe is reached, the highest point of the Smeroe, which is 12,044 feet above the sea, and situated on the north of the mountain. It is a flat top, covered with angular blocks and other ejectamenta from

the crater. It is separated by a depression from the crater and the other point on the south-east which is overlooking the crater.

Fig. 4 is taken from the Mahameroe, showing the other point. Although it looks higher in the photograph, there is a declination of 2° from the former to the latter. On the right-hand side of this is situated the crater. Fig. 1 shows the configuration of the summit before and after the great eruption of 1885, and it seems that before the crater —known as the Djonggring Seloko—was intact, whereas now it is open on the south side of the mountain.*

The point referred to on the side of the crater, which is, of course, part of the crater wall, is sometimes known as the Smeroe proper. It can be reached in half an hour from the Mahameroe, but the ascent is attended with some danger on account of the proximity to the crater; but the whole top of the mountain is subject to missiles from the sudden and capricious outbursts. The guides and coolies appeared to be very

FIG. 4.—VIEW FROM THE MAHAMEROE, SHOWING THE SOUTH PEAK (SMEROE PROPER), WHICH OVERLOOKS THE CRATER.

fear-stricken, probably as much from awe of their deity (the volcano) as from the danger, being anxious to go down, and none of them would

* Also, there was reported to have been a small depression, in the form of a crater, on the east of the summit of the Mahameroe before the eruption of 1885 (*vide* Fig. 1), which was filled up during that eruption; possibly the ancient lava-stream on the east flank of the cone (visible in Fig. 3) may have originated from this crater; there are also vestiges of a former lava-flow near the summit on the same side.

accompany me to the other point. Being anxious to see the crater and get a photograph of it, I rapidly descended to the hollow and followed along the ridge to this point, where the whole of the crater may be viewed.

On the ridge leading to this point there was a large block, fully one and a half tons in weight, which was radiating out a considerable amount of heat; and a small piece split off the side, which I wanted as a specimen, was still so hot that it could not be held in the hand. This block, therefore, could only have been lately ejected.

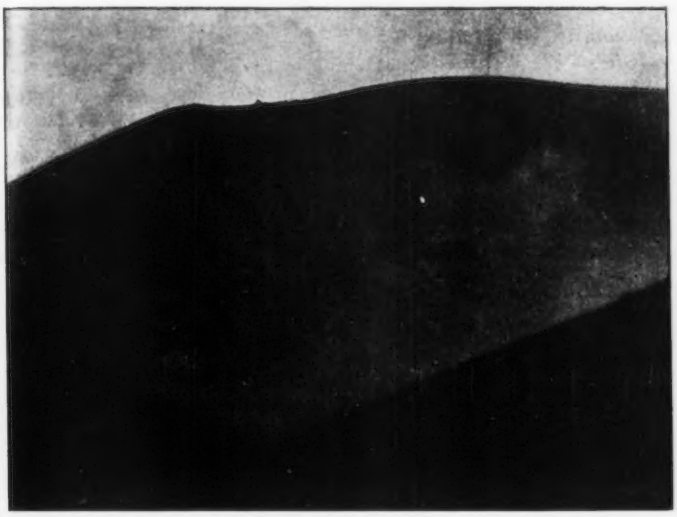


FIG. 5.—THE CRATER.

The crater is not very deep, and the surface consists of sand with blocks of lava, just the same as on other parts of the cone. There were small quantities of steaming liquid lava and sulphur scattered about the sides of the crater, and some close to the summit of this point. These had been shot out by the blasts of steam. Fig. 5 is a view of the crater from the adjacent point.

Having returned to the Mahameroe we waited to witness an outburst, but it was about half an hour before one occurred, and then only a small one, the stones ejected by the steam blast falling in or near the crater.*

* This periodic and rhythmical nature of the eruptions may be explained in the following manner. As might be expected, there is probably a column of liquid lava in a state of ebullition in the volcanic neck, and the top of the chimney being filled and covered with solid materials (blocks, sand, etc.), formed in the first instance by the

It was fortunate for us that we did not wait for the next eruption. Making a rapid descent down the side of the cone, sliding over the loose sand and stones, half an hour sufficed to reach the verge of the woods.

The idols were reached in one hour from the summit, and here the natives again prayed and gave thanks for our safe ascent and return. On the way down from this place to the foot of the cone there was a prolonged roar from the top, and the noise of falling rocks. We were in the woods, and could not, of course, see the top of the mountain. On reaching the place where the horses were left, the coolie with them said there had been an eruption, rocks falling down the sides of the mountain.

It was a tedious journey returning to the camp at the lake through the long grass, which got entangled in one's legs and the stirrups. We reached the camp just before sunset, and on the next day returned to the Tengger.

The lava of the Smeroe is a beautiful green rock with well-defined plagioclase crystals, the glassy ground-mass giving a vitreous or resinous lustre: it is a pyroxene andesite. At the northern foot of the cone there is an older lava which has a red colour, arising from the decomposition of its ferruginous ingredients, also containing plagioclase phenocrysts and some pyroxene.

REVIEWS.

ASIA.

Afghanistan.

'Afghanistan.' By Angus Hamilton. London: Heinemann. 1906. *Map and Illustrations. Price* 25*s. net.*

As an amateur contributor of useful information to the Intelligence Department of the War Office, Mr. Angus Hamilton probably stands unrivalled. The results of a year's travel in Central Asia and a year's study of the literature bearing on the subject of Afghanistan are combined in this one volume, and if the year's travel did not take him over the borders of Russia into Afghanistan itself, it at any rate enabled him to collect a mass of information at first hand bearing on the relations of Russia to that country which may be accepted thankfully as a most useful contribution to our knowledge on the subject. If the subject-matter of the book had been the Russian borderland in Central Asia rather than "Afghanistan," it would perhaps have been more within the limits of the author's grasp. So far as Afghanistan is concerned,

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solidification of the top of the molten lava, there is not a free transit of the steam from below; accordingly, as the bubbles of steam rise from the molten lava, the steam collects over the column and in the crevices and cavities of the plug of *débris*, until sufficient pressure is generated for the steam to force an exit, blowing out, with also small quantities of liquid lava, blocks, sand, and clouds of dust. As the blocks and other materials settle down and rearrange themselves after the passage of the steam blast, and solidification of the top of the lava column is taking place, the barrier must vary in effectiveness, and this, together with the extent of ebullition in the liquid lava, would influence the force and frequency of the outbursts.

Mr. Hamilton has necessarily been dependent on the work of others, and his selection of authorities is not always a happy one. Any compilation, however, which lumps together in one review so much information gathered from so wide a field must have a considerable value—the value which an official gazetteer would have if it were offered to the public by the War Office. As no such offer is likely to be made, Mr. Hamilton's book will probably rank as a standard book of reference for many years to come. Mr. Hamilton's style of writing naturally lapses occasionally into that of the gazetteer rather than of a popular descriptive geographical work, and his use of Russian and Persian equivalents for measures, weights, and distances does not add clearness to his statements. Nor can the map be altogether commended as an enlightened illustration of modern Asiatic geography. The spelling is inconsistent. It might almost be regarded as one of those "reversions" to an original type which occasionally check the course of a too rapid development in the general scheme of natural progress. The map is not, however, the only, nor the most important, part of the book which wants amendment in order to bring it to the level of modern requirement. The extreme pessimism of Mr. Hamilton's views as regards Russia is happily rare in these days; when the real value of Russia as a military power, and the possibilities of an annexation of India to her Asiatic dominions after a successful invasion through Afghanistan, are weighed by the light of what is positively known both of her powers of offensive military action and of the physical difficulties of the Afghan bufferland. Also, Mr. Hamilton treats the question too much from the European standpoint, as if it were the question of a fight between two European countries for the possession of a slice of Asia.

Needless to say, this is not the popular view of the subject either in Afghanistan or in India, as Mr. Hamilton would have learned had he been in those countries. In Asia it is regarded as an Asiatic—as a Mohammedan—problem, and the question at issue is the destruction, or maintenance, of that which many Asiatics regard as the first Mohammedan state in the world. As to the fighting capacity of Afghanistan, the author adopts the superficial view that an Afghan army would be a contemptible force in the field, basing his theory on want of discipline, of leading, and of modern military weapons. The last want may certainly be remedied, and the two first would admit of much modification under the pressure of actual service. Without any of these three undoubtedly important factors in the composition of an efficient military force, it is not for Englishmen to belittle Afghan fighting capacity with the memory of the Khaibar, of Maiwand, Kandahar, Sherpur, and Ahmed Khel fresh in our memories. But this is, after all, but idle speculation. It would have been more to the purpose if Mr. Hamilton had given us his views on the possibility of the existence of any basis for a sound and lasting agreement (as agreements go in this changeful world) with Russia, arising out of her own schemes for peaceful developments in Asia, or out of ours. In the opinion of some of those who should be competent to judge, such a basis does exist; and, inasmuch as we are approaching gently and slowly, but surely, towards that point where a mutual recognition of the advantages of an international agreement will become the popular view, we shall probably soon hear more about it. Setting aside Mr. Hamilton's pessimistic views, we are only too glad to recognize the value of his book. His patience and his research have resulted in the best general compendium of the actual condition of affairs in Afghanistan as they exist at the beginning of the twentieth century that has yet been given to the public, and even when the lapse of a few more years may make large alterations in his statistics, and witness a possible total change of face on the part of the ruling authorities in Afghanistan, the book will still be valuable for the wealth of accurate detail which it contains about much which is as permanent as the everlasting hills.

T. H. H.

Central Asia.

'Mongolia i Kam. Trudi Ekspeditsii Imperatorskavo Russkavo Geographicheskavo Obshchestva, covershenno v' 1899–1901 gg., pot rukovodstvom P. K. Kozlova.' Vol. i. parts i. and ii. St. Petersburg: 1905. Pp. 732.

Kham was the proposed goal of Prjevalski's fifth expedition, which he did not live to carry out, and Roborovski was struck down by illness on the threshold of Eastern Tibet. Kozlof, who had accompanied Prjevalski, Pevtsof, and Roborovski, determined to explore this part of Central Asia, and in the spring of 1899 crossed the frontier to Kobdo, whence he gained the Mongolian Altai. East of the meridian of Kobdo this range assumes a different character, rising only in three points above the limit of perpetual snow, and partaking of the drought of the adjacent Gobi. Having made an excursion from the Artza-Bogdo mountains into the Gobi, the expedition turned southwards to the Kuku-nor and westwards to Tsaidam. Then began the most interesting part of the journey, in which Kozlof and his companions marched through the little-known country of Kham as far south as the vicinity of Chamdo, returning northwards by a more easterly route from Khor-Gamje on the Ja-chu. South of the Dividing range, between the basins of the Hwang-ho and Yang-tse-kiang, three great ranges running from north-west to south-east were crossed, to which Kozlof gave the names of the "Pundit A.-K.," "The Imperial Russian Geographical Society," and "Woodville Rockhill," while a smaller range on the upper Yang-tse-kiang, or Di-chu, was selected to commemorate the unfortunate Dutreuil de Rhins. These mountains are of considerable height—up to 18,000 feet at least, and many of the passes are over 15,000 feet. The country contrasts strongly with Tibet proper. Being within the range of the south-west monsoon from the Indian ocean, it receives abundant precipitation. The valleys are clothed with vegetation, which becomes more luxuriant towards the south, in the basin of the Mekong, and harbours a large variety of wild animals and game birds. Even in winter the climate is mild for such an altitude.

At the Mekong Kozlof reached the furthest point of his journey, being prevented by the armed opposition of the Tibetans and the protests of the authorities from entering the sacred province of Lhasa, or even visiting Chamdo. On his homeward journey he again passed by the Kuku, and crossed the Gobi by a route to the west of Prjevalski's. He has much to say on the manners and customs of the Mongols and the people of Kham, and on the flora and fauna of the country. Among the specimens he obtained was the "jara" (*Nemorhœdus khamensis*), a link between the antelope and the goat, the Chinese leopard (*Felis fontanieri*), the white Tibetan pheasant (*Crossoptilon thibetanum*), and the ape (*Macacus vestitus*). This animal is never molested by the natives, who fear to incur the guilt of murder by killing a creature so like a human being. Kozlof is the first traveller who has navigated the Central Asiatic lakes to any great extent, having taken with him a collapsible boat with a view to collecting plankton.

The work is accompanied by maps, showing the geographical results of the exploration, which was extended on either side of the main route by the excursions of Kozlof's companions, MM. Kaznakof and Ladigin. Some of the excellent views represent charming Alpine scenery, and one strikingly portrays the utter desolation of the Gobi hills.

AMERICA.

Alaska.

'The Geography and Geology of Alaska: a Summary of Existing Knowledge.' By H. Brooks. With a section on Climate by Cleveland Abbé, jr., and a Topographic

Map and Description thereof by R. U. Goode (U.S. Geological Survey, Professional Paper No. 45). Washington: Government Printing Office. 1906. *Maps and Plates.*

Alaska, though still only an "unorganized territory, district, or colony" of the United States, without a territorial form of government, is developing so rapidly that the attention of many explorers and surveyors—officials of the Federal Government as well as private investigators—has been turned to it. Within the last eight years papers and books on the country have appeared in great numbers, so that an official summary of existing knowledge is especially welcome to the student of geography. Very great progress has indeed been made in this short period in the investigation of both the topography and geology of Alaska, and it is now possible to obtain some idea of the relationship between the structure and surface features of the country, though the conclusions on this subject must be only tentative as yet. The detailed topography is very complicated, and the country is best treated of in its four main natural regions—the Pacific Mountain system, the Central Plateau, the Rocky Mountain system, and the Arctic Slope region—which are continuations northwards and westwards of the familiar orographic divisions of the western United States and Canada. The Pacific system is a mountain mass from 100 miles to 200 miles wide, rising steeply from the coast and generally dropping sharply on the northern side to the interior plateau. It consists of four main divisions – the coast, Alaska, St. Elias, and Aleutian ranges—and these all, with the exception of the last, which is volcanic in origin, its anticlinal axis (north-east to south-west) showing a series of cones of the typical ash-built form, give evidence, in the striking uniformity of the height of their summits, of having been carved out of an older highland whose surface had been previously base-leveled. The whole pacific zone has been subject to many dynamic revolutions, but these crustal movements have had no direct effect on the present topography, which is of a very youthful character. In the Alaska range the main central mass of the system (crest-line from 8000 to 10,000 feet), the presence of enfolded Eocene beds in the heart of the mountains, indicates extensive disturbance since early Tertiary times, and the uplift from which the present mountains were carved was probably later than this Eocene deformation, and took place in the middle or later Tertiary period. It was a differential elevation, with its maximum line along the present crest of the mountains, and the uplift rejuvenated the sluggish river systems of the old peneplain, and, being slow and probably intermittent, the larger streams were able to maintain their old valleys, so that the present main drainage channels have been determined by antecedent conditions.

The Rocky Mountain system is of about the same width as the Pacific zone, but has a less marked relief, its crest-line being from 5000 to 8000 feet high. It rises from the central plateau in a gradual slope, but drops sharply to the plain of the north. This region is less known than the southern mountain system, but sufficient evidence has been obtained to show that it also has been subject to many periods of disturbance. Two anticlinal axes can be distinguished, separated by a broad syncline, following an east-to-west line. The last of the crustal movements must have taken place in early Tertiary times, as the Eocene strata are gently folded, while the Pliocene are undisturbed. Like the Pacific zone, this region was then reduced to a peneplain, and subsequently uplifted along the same east-to-west line, the rivers taking consequent courses to the north and south. The main drainage, as far as it is known, is transverse, only the smaller tributaries taking longitudinal courses, with the exception of the Kobuk and Noatak rivers, which flow in broad longitudinal valleys, dividing the western end of the system into distinct ranges.

The central region of Alaska is a dissected plateau, whose surface is cut up by numerous river-channels, the interstream areas presenting an even flat-topped

appearance. These have no constant relation to rock structure, being formed by the upturned edges of both hard and soft strata, and the surface is, in fact, "entirely discordant to the highly contorted metamorphic rocks which make up much of the plateau." Its general form is that of a broad shallow trough, the axis coinciding with the river Yukon, from 4000 to 5000 feet high at the edges, and 3000 feet in the centre. The rivers have carved out broad valleys several thousand feet below the summit level, with gently sloping sides, except in a few cases where recent local uplift has caused an acceleration of stream-cutting. A not uncommon feature of the plateau is the presence of broad flat lowlands, shut in by steep scarps in the surrounding highlands. The Yukon flats, with an area of about 20,000 square miles, is the largest of these "basin lowlands," the existence of which is explained by changes in the cutting power of the streams caused by barriers, probably due to warpings in the crust of the Earth. Within the basins the rivers are sluggish, and aggradation is going on, while in the narrow exits the channels are being rapidly cut down.

The Yukon plateau is the oldest part of Alaska, containing a belt of Archæan gneiss, and here, probably, lies the protaxis of the north-eastern part of the continent. The Eocene sandstones and conglomerates of the Yukon valley are closely folded and faulted, so that the base-leveling of the plateau must have been as late as the middle Tertiary period.

The correlation of the various peneplains is a matter of considerable importance in the interpretation of the physiographic history of the Alaskan region. Mr. Spencer has already contended that the Pacific Mountain system and the Yukon plateau were planated at the same period,* either late Eocene or Miocene, and that the present relief is largely due to subsequent differential uplift. The author of the present monograph supports that contention, and further correlates with these peneplains that of the northern Rocky Mountain zone, which Mr. Schrader had considered to be an older planation surface. Mr. Brooks includes also the Anaktuvuk plateau, on the northern margin of the Rockies, forming part of the Arctic Slope region, which is very similar in character to the Yukon plateau. It is about 60 miles wide, and stands at an elevation of 2500 feet, falling in a well-marked escarpment to the lower level of the coastal plain, a constructional plateau of fluvial formation.

The coast-line of the Arctic ocean, and that of the Bering sea also, is uniformly straight, with gentle inland slopes, broken in parts by a series of terraces marking old sea-beaches and indicating recent elevations. The Pacific shore-line, on the other hand, is very irregular, with numerous deep inlets, suggesting recent depression. But although these fiords of south-eastern Alaska have all the characteristics of a drowned topography, it must be noticed that much of the erosion of the channels now below high-water line was the result of glaciation. Except in this region, however, glaciation has had only a small effect on the topography. The ice from the coast and St. Elias ranges, uniting with the cordilleran glacier, did indeed block the southward-flowing streams, such as the Alsek, and divert them to the Yukon, and in the case of this river the diversion of some of its headwaters has been permanent. In all the higher ranges, also, cirques and U-shaped valleys are the typical forms, but they are regarded as only modifications of a previous topography. N. E. M.

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* A. C. Spencer, "The Pacific Mountain System in British Columbia and Alaska." *Bull. Geol. Soc. Amer.*, vol. 14.

GENERAL.

History of Colonization.

'Die Territoriale Entwicklung der Europäischen Kolonien.' By Prof. Dr. Alexander Supan. Gotha: Justus Perthes. 1906.

In his desire to supply a marked deficiency in our historical literature, the author of this work has attacked a subject which might well daunt the most learned and industrious historian. To crowd into the space of a single volume the world-wide expansion of the territory and influence of the European races during the last four centuries, even with the proviso that the work is to be a compilation rather than a monument of original research, is a task requiring special aptitudes and methods, if the result is to be anything more than a mere dictionary of reference. The chronological rather than the regional treatment is adopted as being most suited to the object in view; and the work is divided into periods, in each of which is set out the territorial development of all the different regions of colonization. It is evident that only on some such principle can the essential unity of the whole movement of expansion be preserved. But there are two kinds of chronology—that of the chronicler and that of the historian. The use of dates depends on the point of view adopted, and a list of dates explains nothing, in the absence of a clear expression of the principles, either political and economic or geographical, which underlie the facts enumerated. The principle of orderly development, particularly in the earlier part of the book, is often so buried under a mass of details that it can be disinterred only with the utmost difficulty. Dates in large numbers are inserted which would be more in place in a detailed study of special regions, and place-names frequently occur which could hardly be marked on a world-scale map, while the insets in the text do not always supply the deficiency. In short, the excellent general maps at the end of the volume give a clearer idea of the broad features of colonial development than the text to which they are related. This superabundance of detail is less in evidence in the sections dealing with the nineteenth century. There is more criticism and less uncorrelated fact. The individuality of the author asserts itself with good results, and so we have an interesting and well-reasoned account of recent changes. The value, to the English reader, lies particularly in the standpoint of the author. The interpretation of the motives and methods of English colonial policy by a foreign critic is sometimes startling, and always gives food for thought. The whole volume will be found very useful for reference, as the author is careful to give his authorities, and has worked out the subject with great completeness. He has given in convenient shape information on neglected subjects and odd corners of the Earth which has hitherto been inaccessible to the ordinary reader. But to the geographer or historian who expects to find new points of view, the volume is likely to prove disappointing; while the want of proportion between details and general scheme detracts greatly from its value to the casual student. The dates for the maps are well chosen, and the most fruitful method of study would probably be to examine the maps first with care, and then to seek the explanation in the details of the text.

A. J. S.

An Autobiography.

'A Varied Life.' By General Sir Thomas Edward Gordon. London: Murray. 1906. *Maps and Illustrations. Price* 15*s. net.*

The interest of Sir Thomas Gordon's autobiography commences, from the geographical point of view, with his appointment as second in command to the Kashgar Diplomatic Mission, during the course of which a flood of light streamed

across the hidden areas of Asia, about which only the scantiest information had hitherto been available. The writer's experiences were published in the 'Roof of the World,' perhaps the most striking and appropriate title ever given to a book, which title, it is interesting to learn, was suggested by the late Sir Henry Yule.

Sir Thomas Gordon was, most appropriately, appointed to meet the late Amir Abdur Rahman when His Highness visited Lord Mayo and Rawul Pindi; but of still greater interest is the account, albeit an extremely brief one, of the author's journeys in Persia, during the course of which he visited the Karun valley, Yezd, and Tabriz. As is only natural, the military aspect is repeatedly referred to, and illustrations are given of the Zil-u-Sultan's troops, which were unfortunately disbanded nearly twenty years ago, but the memory of which will perhaps encourage the Persian reformer of to-day. To conclude, Sir Thomas Gordon's career, if it does nothing more, may, at any rate, prove to our youth what a fascinating life of adventure, combined with interest, is still to be found in the gorgeous East.

P. M. S.

THE MONTHLY RECORD.

EUROPE.

The New Route to Ireland.—The new route to the south of Ireland inaugurated by the Great Western Railway Company was opened for public traffic on August 30. Since the opening of the Severn tunnel and other improvements in the Great Western route to South Wales, the most serious undertaking has been the provision of harbour facilities near Fishguard, which has long been recognized as the most favourable starting-point for the cross-channel service. The exact spot chosen for the harbour was at Goodwick, a little west of Fishguard, which lies in a sheltered bay, but has hitherto entirely lacked accommodation for shipping. Extensive blasting of the cliff, and the building of a breakwater on the one exposed quarter, have now supplied a harbour with a minimum of 20 feet of water at the quay-side. The corresponding port on the Irish side is at Rosslare on Wexford bay, which is reached by a service of turbine-propelled steamers, capable of a speed of 22½ knots. Cork is reached in 13 hours from London, Killarney in less than 14 hours; the time taken from London to Fishguard being 5½ hours, and from Fishguard across the channel to Rosslare, 3 hours 20 minutes. It is claimed that Fishguard will attain importance in the future in connection with the mail route to New York and the trans-oceanic services, being some 50 miles nearer to New York than Plymouth, 115 miles nearer than Liverpool, and about 175 miles nearer than Southampton.

Encroachments of the Sea on the Coast of Mecklenburg.—The Mecklenburg coast has, like other of the lands bordering the North Sea and Baltic, from time to time suffered losses from the encroachments of the sea, the last occasion on which a severe inroad occurred being in December, 1904, when, as the result of storms from the south-west and north-west, veering ultimately to the north-east, the level of the sea became abnormally raised on this coast, and considerable damage resulted. The changes thus effected were soon afterwards carefully examined by Prof. Geinitz, of Rostock, who has long been intimately acquainted with the physical features of this coast, and had, only in 1903, published a memoir on the encroachments of the

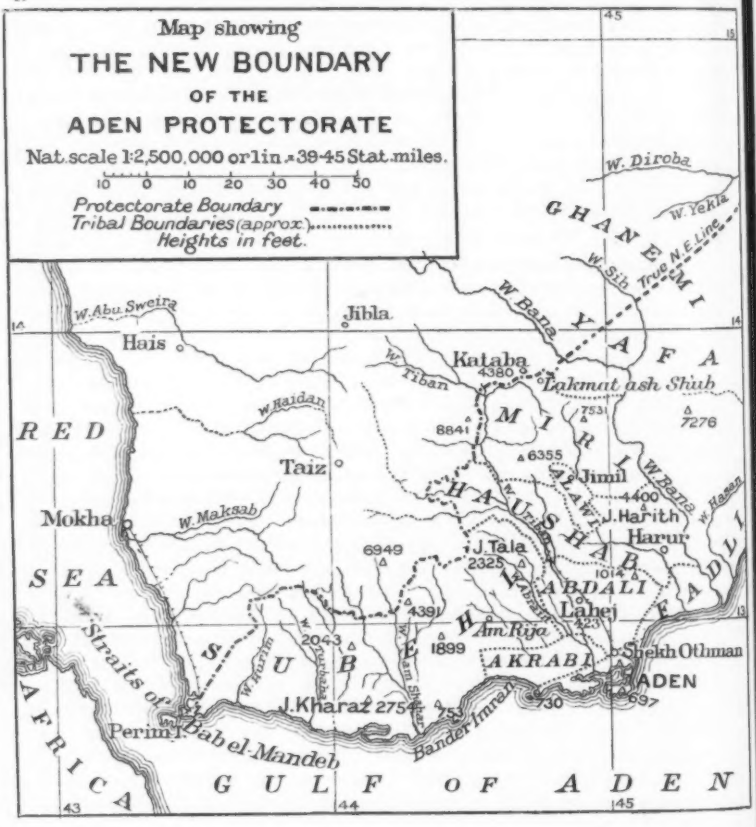
sea thereon. The results of his most recent study have been printed as No. 16 of the *Mitteilungen aus der Grossherzogl. Mecklenburg. Geologischen Landesanstalt* (Rostock, 1905), accompanied by a series of excellent photographs, in some cases showing the state of the coast-line before as well as after the storm of 1904. The structure of the coast varies in different localities, and Dr. Geinitz traces in an instructive way the corresponding differences in the effects of the onslaught of the waves. Dunes fringe the coast in places, whilst elsewhere there is an abrupt cliff formed of sandy and marly strata, known by the name of "klint." As a general rule the dunes were found to have efficiently protected the land behind them, though often in great measure destroyed themselves and occasionally breached so that the sea flooded the low-lying tracts on the landward side. On the other hand, the cliffs were frequently undermined so that large slices collapsed, and it was in these cases that the most serious loss of land occurred. The shore has of late years been protected by a series of low breakwaters, and these suffered considerable damage, though their beneficial effect was traceable, not only directly, but by means of the accumulation of beach material to which they had given rise. A measure of this accumulation was afforded at one spot by a large block of granite which had fallen from the cliff, and in a short time had been completely buried. At another spot Dr. Geinitz was able to accurately measure the retreat of the cliff face (1 metre) by the aid of a block whose previous distance from it had been known. He also gives photographs showing the position of a tree, relatively to the shore, before and after the storm, having chosen it as an example of the action of the prevailing winds. The greatest loss amounted to over 20 yards, this occurring on the margin of the Rostock heath, an area composed of sands, etc., apparently not much above sea-level. By the removal of these strata, the underlying peaty beds were in places laid bare on the shore. Dr. Geinitz noticed that new accumulations of sand were already forming in places, and expresses the hope that the dunes may re-establish themselves before the next severe inroad occurs.

Anthropogeography of Southern Bavaria.—An article by Dr. J. Reindl in the *Mitteilungen* of the Munich Geographical Society (1, part iv.) demonstrates, with copious illustrative detail, how the geography of a region, more particularly its orography and geological structure, prescribes the mode of human settlement, and exercises a determining influence on the character of its population and their mode of settlement. The region dealt with ranges from the Bavarian frontier in the south, northwards to the southern edge of the Jura and the Bavarian forest, and from the Lake of Constance and the Iller on the west to Salzach and the Inn on the east. This region is highly diversified, not only in its orographical and geological, but also in its anthropological features. Very different is the anthropology, *e.g.*, of the somewhat retired but fruitful Algau from that of the unfruitful but more accessible mountain systems of old Bavaria; that of the undulating moraine zone of the Outer Alps from that of the plain of Munich. Even in districts geologically and orographically alike, there is room for important anthropological differences. The Lech, *e.g.*, not only divides language from language and people from people; it still to-day divides also Alemannian from Bavarian settlements. By its endless arms, its woody, rushy, marshy, and sandy islands, and its vast inundations, it opposed great difficulties to transit. Further, its meridional course intersected all west to east ways, and imposed a barrier on expeditions of peoples, armies, and trade. Hence its military importance and the sharp line of demarcation it drew between the inhabitants on either side, also in a moral sense. The anthropogeography of the region falls, therefore, into that of Swabia on one side and of Bavaria on the other. The former, again, is divided into five, the latter into six, sections. A preliminary historical survey notes how on an underlying settlement of lake dwellers, probably Keltic, as

conclusively authenticated in the case of the Würm, Chiem, Schlier, Staffel, Rieg, and Ammer lakes, came the impress of Roman rule. At the end of the fifth century, the extant names of the inhabitants of this region, so far as not newly immigrant German, are Roman; thereon followed the German immigration. The Bavarians (Baujvari) were Marcomanni and Quadi who had formerly taken possession of the land of the Keltic Boii (Bohemia), and thence transferred the name to their new settlements. As in England the Anglo-Saxons gave the name of Welsh to the Romanized Britons, so did the Bavarians to the Romanized Kelts, as is to be seen in the name *Walchensee*, etc. Swabia, on the other hand, became the possession of the Alemanni. Regardless of the Roman form of settlement, the Germans transplanted into this region their own type of settlement, which subsists in part to the present day.

ASIA.

The New Frontier of the Aden Protectorate.—We are indebted to the Director of Military Operations for the copy of a map prepared at the War Office, showing the new frontier of the Aden Protectorate, from which the accompanying



sketch has been reduced. The boundary has hitherto been shown somewhat vaguely on our maps, and had given rise to frequent local disputes, when, in November, 1901, an Anglo-Turkish Commission was appointed to carry out surveys on the spot with a view to its demarcation. The results of the labours of the commissioners were embodied in an agreement signed in April, 1905, according to which the boundary was definitely accepted by both parties as shown in the accompanying map. It will be noticed that to the south-west the line runs down to Husn Murad, not far from Perim island, though it has frequently been shown as reaching the sea considerably further east.

Mr. Calvert's Journey in Western Tibet.—An interesting journey in Western Tibet has been carried out by Mr. H. Calvert, Assistant Commissioner of Kulu. He crossed the frontier to Shipki on July 17 last, and proceeded towards Gartok by the summer route, which had not been previously traversed by any European. Crossing the Chumurti plain (15,500 feet) and the Laoche La, the party reached Gartok, a tiny hamlet of fourteen or fifteen houses and a few tents. Thence Mr. Calvert proceeded to Gargunsa, a miserable hamlet in a swamp, though for nine months the head-quarters of Nari Khorsum, a province 60,000 square miles in area. The return journey to Gartok was made through unmapped country, and was attended with some difficulty. On August 20, Mr. Calvert and the deputy collector of Almora set off for the goldfields, reaching Chukang on the Indus by a hitherto unknown route. The river was here small and fordable, flowing in a steep narrow valley. Thok Jalung, the famous goldfield, was found to be practically deserted, all the diggers having migrated to Thok Dalung, which was reached the next day. Mr. Calvert met the "serpon," or official sent from Lhasa to collect the gold tax, and made a thorough inspection of the gold-fields, being the first European to do so. Rudok, a picturesque village on a rocky eminence, was next reached, but was found to be largely in ruins. From Rudok Mr. Calvert proceeded to Tashijong, a large monastery on the Indus, and reached Shipki by way of the Bongru La (18,600 feet), the Chumurti plain (16,000 feet), and the difficult Badpo La (19,400 feet). For weeks the party had never been below 15,000 feet. The Tibetans were generally friendly.

The Hejaz Railway.—A very full and interesting account of the progress of this line under construction from Damascus to Mecca is given in a recent supplementary number (154) of *Petermanns Mitteilungen*, by Auler Pasha. Some information is also given in the *Bulletin du Comité de l'Asie française* for September, 1906. At present the line reaches Tebuk, 750 kilometres from Damascus, the total distance being approximately 1750. It is expected to be completed in 1913, or 1910 if the sections between Jiddah and Mecca and Mecca and Medina are simultaneously put in hand. One of the greatest obstacles was the carriage of materials, which had, at its inception, to be brought entirely by the French line from Beirut *viâ* Damascus to El Mezeirib, in the valley of the Nahr Yarmuk, a tributary of the Jordan from the east. Attempts to purchase the French line failed, and Turkey was obliged to construct a parallel line to Deraah, just west of El Mezeirib. The British concession from Haifa to Damascus was, however, purchased, and the line completed to Deraah. Owing to the necessity of making a stone bridge over the Jordan, and of constructing tunnels and aqueducts, this has formed, up to the present, the most expensive and laborious section of the route. Even with Haifa as base of operations for materials, land carriage is found very expensive, as from Maan onwards to the present terminus, all water as well as food has to be brought by rail. Hence the late attempt to extend the Turkish sphere in the neighbourhood of Akaba can be explained as much by economic as political reasons, since easy access from the Red sea to the main line would materially expedite the work. The object of the line is partly political and partly religious, subscriptions having been

obtained for it from numerous Mohammedans interested in the pilgrimage to Mecca. As it seems, moreover, to have already considerably diminished the expenses and hardships involved in reaching Mecca from the north, it is probable that there will be no difficulty in obtaining the money necessary to complete the work, though beyond Maan it will be solely a pilgrim route. Its importance will become very much greater when the Euphrates valley railway is completed, and Damascus linked up with Constantinople. The work, even so far as it has gone, is an undoubted achievement on the part of Turkey, the manual work having been done by soldiers, whose experience will considerably add to the strength of the Turkish army. Nearly all technical work had necessarily to be done by foreigners. So far as the present survey of the continuation of the line to Mecca can determine, there will be very little in the way of engineering difficulties to contend with, but ever-increasing obstacles to the obtaining of fuel, water, food, or materials as the railway advances further and further from its base. Definite advance is, however, being made, and it is hoped that the water difficulty may be partially solved by the construction of huge cisterns to store up the scanty rainfall. A very complete account is given of the history and construction of the line, and the country through which it passes is fully described. There is also a sketch-map and a section of the route.

The Franco-Siamese Frontier.—The delimitation of this frontier by the commissioners of the two countries has made considerable progress during the past year. The work on the southern section, from the coast by the Tonle-sap to the Dang-rek chain of mountains, was referred to in September, 1905 (p. 331), since which date the delimitation of the northern section, including the frontier of Luang-Prabang, has been proceeded with (*Bul. Comité de l'Asie Franç.*, September, 1906, with map). The result has been once more to slightly modify the line as originally drawn, in favour of France. In the extreme north-west, the frontier fixed in 1904 was to have followed the first line of heights west of the basin of the Muang Khop, a small stream entering the Mekong at the elbow below Chieng Khong. But as it was found that the historic frontier of the kingdom of Luang Prabang had always followed the meridional range of the Phu-Pha-Dai, further to the west, this was adopted in the place of the former line. To the south of the kingdom, where by the Protocol of June, 1904, the line had been shifted to the advantage of France, so as to follow the upper course of the Nam Huong instead of its northern tributary the Nam Tang, the delimitation has still further extended the French sphere, since the Nam Man, recognized in 1904 by both parties as the upper course of the Nam Huong, has proved to rise much further south than had been expected. The result is to give France a narrow wedge of territory (between the Nam Man and the Mekong-Menam divide) running far into that of Siam, and intersecting one of the main routes between the two river-basins. The frontier so constituted, though no doubt conforming to the letter of the agreement, is hardly in accordance with natural fitness. From the October number of the paper above referred to we learn that Colonel Bernard, the French commissioner, has started for Indo-China, to complete the delimitation in the middle section, between the Tonle-sap and the Mekong.

Archæological Questions in Turkestan.—Mr. A. Cahn, a Russian traveller who has made various tours in Russian Turkestan, especially around Lake Issyk-kul, sends some notes on questions of archæological interest which have not yet been fully elucidated by explorers. One relates to the tradition, held locally, that beneath the waters of Issyk-kul there are ruins of former cities, supposed to have been overwhelmed by some past seismic catastrophe, such as has more than once visited the region in modern times. At Koi-sary, on the south-east shore of the lake some 40 miles from Prjevalsk, remains of household utensils, etc, have been

found in the water, and during a visit to the spot Mr. Cahn made an attempt to obtain some definite information about them. He examined a broad stretch of the muddy shore as far as the depth permitted, and the objects found included fragments of burnt clay pots decorated with straight and spiral lines, some bones of men and domestic animals, and hard clay squares reminding him, in shape and size, of the tiles by which the walls of mosques are decorated in the more southern parts of Turkestan. He found, also, a flat disc of black fossilized wood with a hole in the centre, which he suggests may have been used in a flour-mill. He learnt that the Kirghiz had once found an unbroken oval bowl 10 or 11 inches high, as well as an iron bracelet. It is also reported that the dim outlines of walls and buildings can sometimes be seen when the water is clear. For further examination, divers, or at least a boat, would be needed; but the latter cannot be obtained on the whole southern shore or even at Prjevalsk. It is thought by Prof. Nikolsky that these remains date from the time of the Ussuns, who settled in this region in the second century B.C. when driven from Western China by the Huns, and lived here till the fifth century A.D. Mr. Cahn also refers to remains to be found in many parts of the Alatau, some having the character of mountain forts and others of fortified posts on trade routes. On the north coast of Issyk-kul, near Preobrazhensky village, there is a system of angular forts, surrounded by moats filled from the lake. They are said to have been built by Timur, and in the centre lies a row of granite figures resembling the stone figures common in Southern Russia, which represent human beings in a recumbent posture. Another ruin is not far from the Naryn fort, on the At-bashi river, and lies in a broad valley. This fortification had extremely thick walls of beaten clay, surrounding a regular square court, and an aged Kirghiz declared that it was built by Koshoi, general under the Khans of the Golden Horde in the fourteenth century. The walls are in great part still standing, and reach a height of 70 feet and a thickness of 20 to 25 feet. The famous Tash-robat ("The Stone-house"), not far from Chatyr-kul, is built of basalt blocks bound together by layers of hard cement, and consists of forty rooms symmetrically arranged round a central hall, which has a dome-shaped roof. It is still in good preservation and affords shelter for caravans, but its origin is unknown. In the gorge of the Barskaun river, in the Terskei Alatau, there are two granite slabs, leaning one against the other, and bearing short inscriptions in Arabic. They are much revered by the Kirghiz, who come here when childless and leave the horns and hoofs of animals they have killed and eaten, as offerings between the slabs. Among the natural phenomena, the peculiar outlines of the crumbling hills bounding the Chakmak valley, on the caravan route from the Turgart pass to Kashgar, deserve mention. From a distance they present the appearance of Gothic towers.

AFRICA.

Mr. Vischer's Journey across the Sahara.—Mr. Vischer (*Journal*, vol. 28, pp. 181, 507) wrote from Murzuk on September 15, giving some account of his experiences up to that point. He had, in the main, followed Barth's route, passing through Mizda and the Hammada el Homra, and afterwards keeping more or less closely to the route of E. von Bary to Tekertiba and Murzuk. He had taken copious notes and observations for a route-map, and with the help of the Turkish officer who accompanied him had obtained much information on the tribes along the route. Murzuk had apparently changed little since the days of Rohlfs and Nachtigal, though its importance as a trade centre had declined. Mr. Vischer thinks that this will be regained with the returning prosperity of Bornu. The political situation was not very favourable to travellers, partly owing to the French occupation of Bilma and advance towards Ghat, and partly from disputes between the Tibbus and Tuareg. The Arab tribes further north seemed less under control

than formerly. While passing through the Hammada and the enormous sand-dunes south of it, Mr. Vischer had excellent opportunities of studying the influence of wind and changes of temperature on the desert formation. In the hill country beyond Gharian, he made some examination of the Roman ruins and of the underground dwellings, and observed considerable areas of petrified forest before reaching Murzuk.

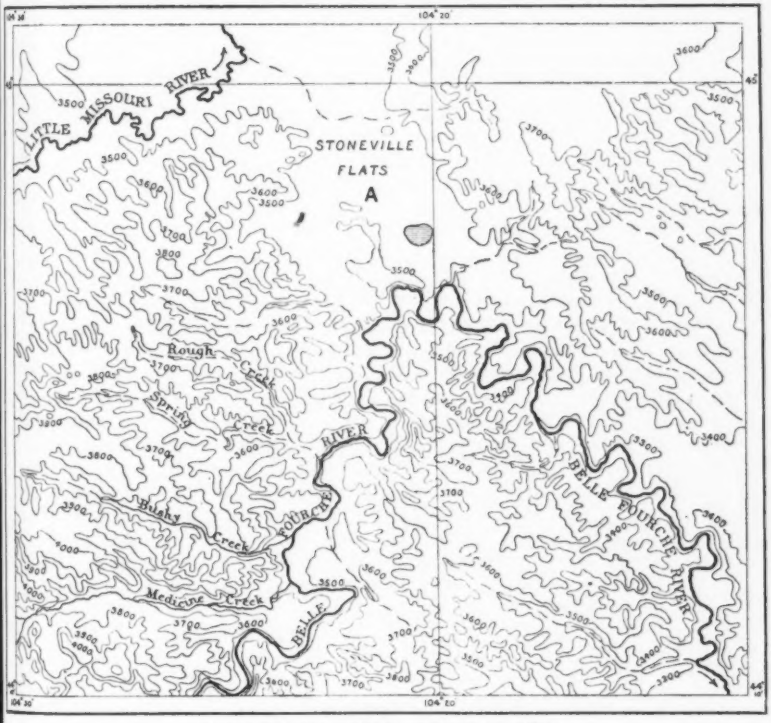
Commercial History of North-East Africa.—In a well-digested article in the *Geogr. Zeitschrift* (19th year, 5th and 6th Nos.)., Lieut. Kürchhoff discusses the history of trade-routes and trade-centres in North-East Africa. Ranging in space as far south as the Victoria Nile, and as far west as Lake Chad and Bagirmi (the common frontier of North-East and North-West African trades), the article deals more particularly with the period from the beginning of last century to the present. The main gateway of entry and exit for the movements of people and goods is, of course, the Nile. Since the Turkish conquest of Egypt, Cairo has been the chief focus of trade with the southern lands. Over 500,000 before the cholera of 1833, its population thereafter dropped to 300,000. At the opening of the nineteenth century three great caravan routes transported slaves and ivory from the interior to Cairo, from Murzuk, Darfur, and Senaar. The caravan from Murzuk arrived generally a little before Ramadan, one part proceeding thence to Mecca, the rest awaiting in Cairo the return of pilgrims from Morocco. But, controlled as were the movements by the political situation in the interior, the caravans from the south arrived when they could. Two or three might arrive in one year; two or three years might pass before another arrived. From Cairo the routes to Darfur and Senaar followed first the course of the Nile; that to Darfur leaving the river at Siut (the most important town of Upper Egypt at the beginning of the nineteenth century), that to Senaar at Assuan. On the Egyptian occupation of Dongola, a caravan route was opened thence to El Obeid, and another to Shendy. The revival of Dongola carried with it the development of Wadi Halfa. By 1825 Senaar and Kordofan were brought under Egyptian rule. Founded in 1823 as a basis for further conquests, Khartum, from an insignificant fishing village, expanded by 1858 into a town with a population of 30,000, and by 1885 of 50,000. Drawing into itself the whole North-East African trade, Khartum continued, till its destruction by the Mahdi, the reigning emporium for Central African products. After describing the conquest of the Sudan, the article presents a succinct but picturesque account of its principal trade centres.

AMERICA.

Sir William Macgregor's Visit to the Coast of Labrador.—Though Labrador is physically a fringe of the Canadian continent, it is in many ways much more a kind of annexe of the great island of Newfoundland, from which it is separated only by the narrow strait of Belle Isle, and with which it was at one time politically associated. When, indeed, in 1774 it was transferred to Quebec, the Governor of Newfoundland was still instructed, not only to look after the fishing and maritime interests of Labrador, but to continue and protect the establishment of the Unitas Fratrum, or Moravian Brotherhood. This notwithstanding, Governor Macgregor is the first Governor of Newfoundland to pay an official visit to the western seaboard of the strait. His report is full of interesting matter in regard to the country and its people, and their social and economic condition. The total winter population of Labrador is only 4000 (about 1000 native Innuit and half-breeds, or "settlers," as they are locally called); but the influx of fishermen, etc., brings the number up to 20,000 to 23,000 in summer. The exports in 1905 amounted to $3,082,563, of which dry cod represented $2,938,488, the remainder being made up of sealskins, salmon, furs, timber, whalebone, etc. Agriculture there is practically none. The Moravian missionaries with great difficulty grow

a few cabbages, turnips, and (protected by mats) potatoes. In regard to the climate, Sir W. Macgregor gives abundant details of observations. At Hopedale (55° 27′ N. lat.) the maximum temperature was in 1890 only 30°·9 Fahr. for April, 55°·0 for May, for June 70°·3, July 82°·2, August (the hottest month) 86°·2; and the minimum of these months were −11°·5, −6°·9, 20°·5, 27°·3, 27°·8. Spring really comes in late summer. In the beginning of August, at Chateau, cabbages and turnips were only 2 or 3 inches high, the rowan-tree was in early flower (though the fruit was red at St. John's, Newfoundland), the larch, too, was in flower. The cloudberry (locally "bake-apple"), which in Scotland is found not lower than at an altitude of 1200 or even 1500 feet, grows here on the coast, as does the cranberry (or "partridge berry"). Not only is the interior of the country largely *incognita*, thanks mainly to the hideous plague of mosquitoes and "black flies," but even the best and most recent charts are extremely defective and erroneous in their delineation of the many-fiorded coast, with its countless bays, "tickles," and islands. What appears, *e.g.*, on the map as the solid peninsula of Chidley is really a group of many islands separated by narrow channels of deep water. Sir W. Macgregor has set a good example to himself and his successors.

An Instance of River-diversion is to be seen in the central plains of the United States. Along the east side of the Black hills many of the streams are



Scale 1:200 000 or 1 Inch = 3·16 Statute Miles

Contour interval 100 feet

cutting new valleys, and in cutting back have tapped other streams and altered the drainage system. Thus the upper waters of the Belle Fourche have been diverted from the Little Missouri, of which it once formed the headwaters, to the Cheyenne river, at the sharp bend north of the Black hills (A in accompanying sketch). North of this bend there is a wide flat-bottomed valley, which merges into the Little Missouri valley, and along which the Belle Fourche formerly flowed. It now occupies a new canyon cut about 50 feet below the floor of the older valley. This diversion was due to a small branch of the Cheyenne river, which had a steep declivity and was cutting along the strike of soft shales, so that it had the advantage over the original headwaters of the Little Missouri, and finally tapped them.

POLAR REGIONS.

Commander Peary in the Arctic.—Since reaching the far north towards the end of 1905, Commander Peary had been unable to communicate, as he had hoped to do, with the civilized world, and no news of his doings had come south until, at the beginning of last month, he appeared himself in the *Roosevelt* on the Labrador coast, after his friends had all but abandoned the expectation of obtaining tidings until well on in 1907. Telegraphing to the secretary of the Peary Arctic Club from Hopedale, Labrador, on November 2, the explorer was able to announce that the record of farthest north had been once more won for the United States, since he had made his way to 87° 6′, or nearly 40 miles nearer the pole than the furthest point attained by Captain Cagni, of the Duke of the Abruzzi's expedition in 1900, which was in 86° 33′, itself an advance of 20′ beyond Nansen's farthest in 1895. In achieving this success he seems to have shown his usual pluck and determination, while fighting against odds which made it impossible to attain the pole itself, though a point only just over 200 miles distant was reached. The *Roosevelt* wintered on the north-east coast of Grant Land, near Cape Sheridan, a little north of the headquarters of the *Alert* in 1874–75. On February 21, Peary went north with sledges, reaching Cape Hecla in three days. This formed the point of departure from the land, advance parties being sent on under Bartlett, Henson, and Clarke, while later on Peary went on himself with Henson and a small party of Eskimo. Open water proved a hindrance between 84° and 85°, while beyond 85° a gale, which raged for six days, broke up the ice and destroyed the caches, cutting off communication with the supporting parties, and drifting the explorer and his companions to the east. The furthest point was reached by forced marches on April 21, and during the return journey it became necessary to kill eight of the dogs for food, the party being hard put to it before reaching the north coast of Greenland. During a severe snowstorm the temperature fell to 75° below zero, Fahr. At about 84° a big lead was encountered, and the party encamped on a great floe, which drifted eastward. Only after five days was a passage effected, over young ice which bent beneath the travellers' weight. On May 12, Cape Neumayer was reached. Here they killed some musk-oxen, and made their way along the Greenland coast towards the ship. Both the supporting parties were driven on to the north coast of Greenland, and one was rescued in a starving condition. After resting a week on board the *Roosevelt*, Peary undertook a sledge-journey to the westward, during which he completed the tour of the north coast of Grant Land, and reached other land near the 100th meridian. It is not clear from the telegram whether this was land not previously discovered, or a portion of the lands brought to light by Captain Sverdrup during the second voyage of the *Fram*—a question on which further information will be awaited with interest. The homeward voyage seems to have been made under unusual

difficulties, ice, storms, and head winds being incessantly encountered. The propeller became damaged, as well as the stern-post and rudder-post, the bows were damaged by the fall of the foretopmast, and all the coal was exhausted before the Labrador coast was reached. The *Roosevelt* is said, however, to have proved herself an excellent sea-boat and good at battling with the ice. The health of all on board was good throughout. Commander Peary himself has arrived in New York.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Mariner's Compass Card.—For the prismatic compass used by explorers in route traversing it has for a long time past been customary to graduate the ring into 360°, reckoning from the magnetic north point round by E., S., W. to the starting point. The advantage of this system, specially in plotting bearings, over the older methods of "points," or even of four quadrants of 90° each, is readily acknowledged by all who have any practical knowledge of the matter, and it certainly seems surprising that it has not long since been adopted for the mariner's compass. Doubtless one reason that the change has not been made is the possibility of confusion that such an alteration would be likely to lead to in the maritime world until the new system became generally recognized. However, apart from this difficulty, and the general conservatism in such matters, there seems no real reason why the change should not be made. A compass card, called the "F. Howard Collins's 360° Mariners' Compass Card," is now being constructed on this principle by the makers of Lord Kelvin's compasses, Messrs. Kelvin & White, Cambridge Street, Glasgow, a specimen of which, with accompanying letter-press setting forth its advantages, has been sent to this Society, and there is little doubt that, if it could be adopted generally, as the chief hydrographer to the American navy is stated to have said concerning it, "all work in relation to the compass would be facilitated." In addition to the 360° circle, an inner circle is shown, giving points as usual, which arrangement is perhaps advisable for the present. It would perhaps be too much to expect the makers to divide their card according to the metric system instead of into quadrants of 90°, although this would doubtless be a more rational arrangement, and one which in all probability will come into use in the future.

Ancient Flora of the Southern Hemisphere.—Among the collections obtained in the south by the Swedish Antarctic expedition were certain plant-remains discovered by Dr. J. G. Andersson in the Falklands (Speedwell island) and thought by him to be associated with a marine fauna of Devonian age. On this account, Dr. Nathorst, to whom they were submitted for examination, was at first inclined to assign the most important of them to the genus *Asterocalamites*, though the character of others of the remains made him somewhat doubtful. He has lately pointed out, in a reprint from the *Bulletin* of the Geological Institute of Upsala, vol. 7, that this identification was erroneous, and that the plant in question was in reality a *Phyllotheca*, representatives of which belong to the "*Glossopteris* flora" known from India and various parts of the southern hemisphere, and dating from Permian or Carboniferous times. Should the plant from the Falkland islands be a member of the same group, its distribution in space would extend some 12° to the south of its hitherto known limits in this direction. Although the probability is that the Speedwell island formation belongs to the Upper Carboniferous or Permian, Dr. Nathorst points out that another possibility (for it cannot be regarded as more) exists. The *Glossopteris* flora seems to have displaced an older flora of northern type, and it is not impossible that before doing this its habitat was within the Antarctic. In this case traces of it might be expected to occur in the Devonian of the Antarctic region, and the *Phyllotheca* from the Falklands might be

older than the *Glossopteris* flora known elsewhere, or at least the genus might have made its appearance here at an earlier period than elsewhere. The question can only be solved by further exploration in the south.

GENERAL.

Gift to the Society by the late Captain Wiggins.—In accordance with the will of the late Captain Wiggins, his niece, Miss Kelman, has transmitted to the Society a handsome silver salver, which, with other pieces of plate, had been presented to Captain Wiggins by the Czar of Russia, on account of his continued efforts to establish a commercial route by sea along the north coast of Europe and Asia and up the river Yenisei. Around the border of the plate is an inscription in Russian, and the following inscription has been placed on the centre of the plate by Miss Kelman: "This salver was presented to Capt. Joseph Wiggins, Siberian Explorer, by the Czar of Russia, 1894, and left by Capt. Wiggins to the Royal Geographical Society, England, September, 1905." She has also presented to the Society the charts which were used by Captain Wiggins in carrying out his navigations.

The Ninth International Geographic Congress.—Circulars of invitation to this Congress, which, as is known, is to be held at Geneva in 1908, have been distributed by the organizing committee, and include preliminary announcements as to the programme and general arrangements, which follow, broadly, the lines adopted at former meetings. The proceedings will consist both of general and sectional meetings, the number of sections provisionally arranged for being fourteen. For these, separate rooms will be allotted in the University buildings. Offers of communications will be received up to November 30, 1907, and must be accompanied by *résumés*, distinctly written (preferably type-written) on one side of the paper only, and not exceeding three hundred words. The languages recognized will be German, French, Italian, and English, and besides these Latin may also be employed. Delegates may be named by governments, universities, geographical and other learned societies. A preliminary list of communications offered is printed in the circular.

The International Geodetic Conference at Budapest.—The following facts regarding the proceedings of this Conference (September 20 to 28) are gleaned from a communication made to *Nature* by Sir George Darwin, the delegate of the British Government, who declares that the work of the Conference was more interesting than that of any other at which he has been present. The observation of the variation of latitude, with which the name of Dr. Albrecht is specially associated, was matter of much debate. If the mysterious term z, discovered by Prof. Kimura, in the expression for the position of the pole, represents a real physical factor, it may be concluded that the equator oscillates backwards and forwards parallel to itself. In the southern hemisphere observations have been made in this connection by Dr. Hessen at Bayswater, West Australia, since June 6, 1906, and by Prof. Carnera, at Oncativo, in the Argentine Republic, since May 5. Mr. Innes will probably take observations at Johannesburg. For the northern hemisphere the situations selected are Pulkova, Leyden, Mizusawa, Charjui, Carlsforte, Gaithersburg, Cincinnati, Ukiah, and Tokyo. Prof. Helmert reported on the present position of the whole investigation. A preliminary report was read by Dr. Hecker on his voyages (*a*) from Portugal to Brazil, and (*b*) in the Indian ocean and across the Pacific for the purpose of determining the value of gravity at sea. His conclusions are regarded by Sir G. Darwin as forming one of the most noteworthy geodetic acquisitions of the last twenty years. M. Grullaume, assistant-director of

the International Bureau of Weights and Measures at Bréteuil, described the improvements made in the use of the Jäderin wires for the measurement of base-lines, and especially the base-line measurement of the Simplon tunnel which the geodesists accomplished in five days by working night and day. Sir G. Darwin was happily able to report, *inter alia*, that in June Captain Gordon again began work at the triangulation of Rhodesia, which will in a few months be finished up to and beyond the Zambezi. From Tanganyika the survey northward will fall to the German Government. In Egypt Captain Lyons is preparing to work southwards. In the course of the discussion as to the reply to be given to the Congresses of Geology and of the academies who requested geodetic assistance in investigating the internal distribution of masses in the Earth and the rigidity and isostasy of the Earth's crust, one or two highly important communications were presented. Mr. Tittmann and Mr. Hayward gave an elaborate account of the anomalies of gravity in the United States. Mr. Hayward showed that the matter of the Earth is in hydrostatic equilibrium at a depth of about 70 miles. Baron Eötvos explained his application of the torsion balance to the determination of local abnormalities of gravity.

CORRESPONDENCE.

The Fall of the Central African Lakes: Lake Nyasa.

THE enclosed photograph shows the marks on the rock at Monkey bay, on the west side of Lake Nyasa, placed there by the captains of the various steamers plying upon the lake, and indicating the water-level at different dates during the past nine years, and, as far as its evidence goes, seems to show a regular and persistent fall of the lake-level. The lowest (and latest) date is October 3, 1904, and this photograph was taken on October 19, 1905. When taking the photograph I also personally measured the then lake-level, and found it 15 inches below that mark. There is thus shown by the photograph direct evidence of a fall of some 10 feet 3 inches in eight years, taking the height in November, 1897, as the starting-point.

A further indication of the permanence of the fall is found in the universal native tradition that considerable districts bordering on the lake which are now inhabited, were at one time under water which formed part of the lake, *e.g.* the Tiwi plain. In most cases, however, native tradition is so innocent of definite dates that it is difficult to draw any deductions from it. But in the case of one such tradition the dates can be fixed very definitely. About 20 miles south of Kota-kota the short river Chia still marks the outlet of a "Lake Chia" found on old maps, but now non-existent. About 3 miles south of that is the village of Chididi, picturesquely perched on what is obviously the cliff of this lake, about half a mile inland from Lake Nyasa and facing westwards. Opposite this village I had the place pointed out to me where the *Itala* anchored in what was then "Lake Chia" and is now a dry plain. This would be in 1876. I inquired when the lake dried up, and the reply was "when the Government came." This might refer to 1883, when the first resident British consul was appointed, but far more probably to 1889, when the treaty with Jumbé, the great slave-dealing chief of Kota-kota, was made, and the actual influence of the "Government" was first realized by the natives in this part. It was also stated by the chief of Chididi and others that, within the memory of living men, Lake Chia was but part of a continuous "lake" which

included also the now-existing (but now unconnected) string of lakes, Kanipa, Tabetabe, and Chikukutu. If this were so—and the positions and surroundings of these lakes certainly allow of it—it would mean that this body of water had a connection

MARKS SHOWING FALL OF LAKE NYASA.

with Lake Nyasa, not only near its southern end through the river Chia, but also just north of Kota-kota through the river Kaombe. This agrees exactly with the unanimous assertion of the older Kota-kota natives, that Kota-kota itself was formerly on an island. But the important point, as bearing on the Lake fall, is that the whole physical surroundings show that, on the assumption that there has been since 1876 or earlier a regular fall of the lake, that fall would naturally drain this area, leaving small lakes (as actually occurs) in the deeper hollows of what were, on this theory, part of the lake-bed in comparatively recent times. This is corroborated by the fact that three of these small lakes still exist *without having any source of supply* westward from the hills, which are some distance away and are drained on this side of their watershed by the river Bua, which has its outlet some 16 miles further north than the Kaombe. I have said "since 1876 *or earlier*," because it is evident, from Livingstone's maps, that Lake Chia was not connected with the river Kaombe when he visited Kota-kota. So that this argument, if sound, pushes still further back the date of the commencement of a period of desiccation. A corroborative evidence of this process may be found at various points round Lake Nyasa, where there appear to be evident marks of old "beaches" at considerable distances from the present lake-shore. This was first noticed by Livingstone himself (see *LAST Journals*, vol. 1, p. 94, where he speaks of "two beaches of the lake" near "the confluence of the river Misinjé," "one about 15 feet above the present high-water mark, and the other about 40 feet above that").

There is a great outcry of the European colony at the present time for afforestation, to prevent the serious consequences which seem to be arising from this process of nature.

I am, yours sincerely,

WM. C. PIERCY.

P.S.—Since writing the above, I have heard that in April last the *Charles Janson*, one of the smallest steamers on the lake, crossed the bar at the south end of Lake Nyasa into the upper Shiré river on six occasions, the last time on which either it or any other steamer crossed the bar being about five years previously. But this crossing was due to an extraordinarily heavy but very temporary fall of rain, and its repetition had already become impossible by the end of April. For this information I am indebted to Mr. S. Lyon, the engineer of the *Charles Janson*, but it is doubtful whether the fact that some years ago the bar used to be constantly crossed by steamers has any bearing on the question of general desiccation, as the change in this respect might be accounted for by a silting up of the bar and upper reaches of the river, and by the notorious neglect of the channel of the upper Shiré by the authorities, which has led of recent years to the practically entire cessation of its use as a navigable waterway such as it was a few years ago.

General Report of the Survey of India, 1903–04.

In the *Geographical Journal* for August last, I note a review on the above, the only one I ever had the honour of preparing before my retirement from the department. There are some points which perhaps the writer may not be aware of, regarding these reports, which I should like to mention.

As he says, there is great delay in the publication of these reports. This is in a great measure due to references that have to be made to the foreign and military departments as to the desirability or otherwise of publishing matter connected with all transfrontier work. Then, again, for some years, partly owing to a peremptory mandate from the Government of India, the length of all official reports have been curtailed and restricted to a given number of pages; and the cutting down of the reports of executive officers in charge of field parties, and examining all the proof copies, a task which falls on the Surveyor-General and Deputy Surveyor-General, entails no small amount of labour in order to condense the final report within the prescribed limit of size. Owing to the above restrictions, the reports of late years have been somewhat scant, and void of matters of general interest to the public, a fact which has been commented on by the Indian press; and it was with a view to furnishing something of a more readable nature, I determined to include in the appendix as much interesting matter as it was possible to gather.

Another cause for the delay in publication of the last report was the extra work thrown on the administrative offices by the Survey committee, who were perpetually demanding returns, estimates, and statistics of every conceivable subject connected with the department.

The statement that "there is really very little of the Indian peninsula left to map" is hardly borne out by facts. I can assure the writer that there remain very large areas which will require "resurvey," and not merely "revision." A glance at the 'Report of the Survey Committee,' part i. p. 43, will show that the area to be surveyed is estimated at 655,360 square miles, whilst that for "re-survey" is quoted at 479,000 square miles.

There is no new material in the map of Nepal accompanying Captain Wood's report, beyond what has been in our possession for many years past, and to say that the map is "the work of Captain Wood" is quite misleading. Captain Wood was merely sent to Katmandu to finally set at rest the discussion that has been waged for years past regarding the identification of certain snow-peaks visible from that locality. No surveying of any description was attempted, and to say that "the

passes leading into Tibet north of Katmandu can now be located with a fair approximation to exactness" is purely mythical.

J. R. Hobday, Colonel,
Late officiating Surveyor-General of India.

October 29, 1906.

Missionaries and Philology and Anthropology.

I was much interested in reading Prof. Haddon's paper in the August number of the *Journal*, proposing a systematic investigation of the biology and anthropology of Melanesia, and I sincerely hope that such an expedition may be organized. But I ask your permission to take exception to some remarks made in the discussion following the paper, because they are most unjust to a large body of men who have done an immense deal in various parts of the world to advance the knowledge of language and of folk-lore. I notice that Mr. Ray said that "the missionaries learn the languages, to a certain extent, far enough to be able to produce a Gospel translation, and when that is published, they rarely go any further. Very few of them take down native stories, and no native literature is preserved." Now, both these statements are very far from the truth. I affirm, on the contrary, that no missionary is content with translating a single Gospel, but that the object of every Protestant mission is to give the peoples among whom it works all the New Testament in the first place, and then the complete sacred Scriptures. The annual reports of the Bible Society will fully confirm what I say, and will show that every year missionaries are going on to complete the whole Bible in countries where it is not already completed; and, more than that, they are continually revising and improving first translations as their knowledge of the various languages becomes more perfect. I may cite Mr. R. N. Cust's book, 'A Sketch of the Modern Languages of the East Indies' (Trübner, 1878), Appendix G, to show what had been done by missionaries in the large Indian group of languages nearly thirty years ago, and there have been great advances since. It is the same in China now—a large body of missionaries from all the Protestant Societies are engaged in a careful revision of the Bible; and it was the same with us here in Madagascar. The first missionaries here were indefatigable in completing the New Testament within two years of their arrival, and the whole Bible before they had been fifteen years in the island. And it is the same with my friends of the L.M.S. Mission in New Guinea now. Dr. Lawes, after barely ten years in a part of the island where the language was previously utterly unknown, returned to England with a complete translation of the New Testament, not "a Gospel translation," to be printed by the Bible Society. And although the work is most difficult there in consequence of the number of languages, good progress is being made in studying several of them, and in giving the people the Scriptures in their own tongues. The fullest statement, and most carefully arranged account of what missionaries have done and are doing for philology is, however, given in the Rev. D. Dennis's monumental work, 'Christian Missions and Social Progress,' in three volumes, with a volume of statistics (New York: Revell Company), just completed. Such remarks as those made by some gentlemen are amply refuted by an inspection of facts and figures carefully compiled in Dr. Dennis's volumes. Missionaries have no need to be ashamed of their brethren as scholars, when such names are mentioned as Carey, and Hay, and Chamberlain, and Sherring in India; as Morrison, Milne, Legge, Edkins, and Griffith Johns in China; as Jones, and Griffiths, and Cousins, and Dahle in Madagascar; as Pattison, and Codrington, and Turner, and Wyatt Gill in Polynesia: but the list would be too long were I to attempt to make it anything like

complete. All philologists know, and will gladly acknowledge, the debt their science owes to missionaries in all parts of the world, from the time of John Eliot down to the present day.

A word or two more as regards the second statement, viz. that "very few of them take down native stories, and no native literature is preserved." This is equally inaccurate, and I affirm, on the contrary, that numbers of missionaries are very anxious to preserve and study the folk-lore of the peoples among whom they live, and that a large amount of such material has been obtained by them and put on record. Away from access to libraries as I am in this country, I cannot try to give anything like a complete list, and can only give a few examples; but a reference to the volumes of the Folk-lore Society's proceedings will confirm my statements. As an instance, however, I may just say that here in Madagascar very full lists have been compiled and printed of the native proverbs, and a great many have been translated; two considerable books have been printed, giving a large number of folk-tales, songs, conundrums, children's games, etc., as well as the curious ideas of divination, charms, etc. (in fact, a few of us a few years ago formed a little society for the collection and publication of such literature); smaller books have also been issued, giving native customs, speeches, etc., at marriages, funerals, circumcision festivals, and royal speeches, all of which preserve obsolete or obsolescent forms of the language. I myself have taken much interest in the dialects of the island, and am now proposing a plan to the Académie Malgache for their systematic collection and study; and Dr. Dahle, of the Lutheran Mission, has made exhaustive studies of the divination practices of the people, and also of the language. Now, what we have done here is not an exceptional fact by any means; witness Dr. Turner's book, 'Nineteen Years in Polynesia;' Rev. Wyatt Gill's 'Historical Sketches of Savage Life in Polynesia, with Illustrative Clan Songs;' and 'Myths and Songs from the South Pacific;' Dr. Codrington's 'The Melanesians: their Anthropology and Folk-lore;' Rev. W. Ellis's 'Polynesian Researches;' Rev. R. Taylor's 'New Zealand and its Inhabitants;' Rev. M. A. Sherring's 'Tribes and Castes of India,' etc., etc. The contributions of Chinese missionaries to an accurate knowledge of the literature of China are also well known, such as Dr. Legge's many volumes of the Chinese classics, and the learned works of Drs. Chalmers, Edkins, Milne, and Morrison, and others.

Both philology and literature and folk-lore would be in a bad way were we dependent upon colonists and traders for our knowledge of such subjects; and had not Christian missionaries in all parts of the world, in addition to their chief work of making known the gospel, been determined to study accurately for themselves the languages and ideas of the peoples among whom they live. I therefore have no hesitation in again affirming that missionaries, notwithstanding the disparaging remarks often made about them by those who know least about what they do, have done, and are doing, valuable service to philological and anthropological science.

JAMES SIBREE,
Missionary of the L.M.S.

L.M.S. College, Antananarivo, Madagascar, September 29, 1906.

The Phœnician Periplus of Africa.

I am sorry that my remarks on this subject had to be compressed into so small a space as to lay me open to the criticism pronounced by Mr. Heawood on my letter. To him I would reply—briefly again—as follows. I am not the first to observe that the Phœnician legend, with its impossible harvest-story, would have found little, if any, support in modern times but for the supposition that the alleged report

of a northerly sun must be true because it could not have been invented. I contend, not merely that it could easily have been invented, but that the last persons to deny this should be those who maintain that a Semitic traffic with Sofala had been going on for centuries before Necho's time. Mr. Heawood disputes my suggestion that the statement "startled" the world, or, indeed, anyone beside Herodotus. But surely the statement would hardly have been made had it not been thought remarkable. And that it could be thought remarkable, even by Herodotus, is surely strange if voyages to South Africa had ever been common. Herodotus, Mr. Heawood says, had "pre-conceived ideas." But were not these ideas, at least so far as concerned the extent of Africa, actually inspired by the Phœnician story? And are not such ideas, which were certainly not confined to Herodotus, hard to explain as surviving in the world if a circumnavigation of Africa had really been made? When Mr. Heawood says "the natural conclusion . . . is not so much that the sun was north at noon, as that it was, during the greater part of the day, on the right of the general course sailed," he seems to me to touch upon a weak point in the story. As a fact, in a circumnavigation of Africa, the distance to be sailed in an east-to-west direction is surprisingly small, and most of it is off the Guinea coast, north of the line, where Rennell maintains that the Phœnicians could only have made their way in the autumn, when the sun would be on the left hand. That Herodotus, and better-informed successors of Herodotus, should have fancied the chief part of the voyage to have been from east to west is surely an indication that a real voyage had never been recorded.

I am glad to learn that Dr. Keane does not "rely on the statement of Herodotus," though in that case I cannot tell what it is on which he does rely to prove against Mr. MacIver that the ancients had a knowledge of the Austral regions. I introduced Posidonius chiefly to show that a competent scientific authority, who knew as well as any modern—and much better than some moderns—what a northerly sun would imply, was not impressed by the mention of one. But Posidonius also was an opponent of a theory once widely current, that the equatorial heat was insupportable. How did this idea find a place in a world of which "the Austral regions" had long been known? Of Dr. Keane's wild attack upon Posidonius, as it has absolutely nothing to do with the subject in hand, I will merely say that I can find no justification for it in anything recorded of that eminent man.

I venture to think that Herodotus does speak of a Carthaginian circumnavigation, though no doubt in a provokingly elliptical phrase. Both Gaisford and Rawlinson understand him as saying that, whereas Necho gave the *first* proof, the Carthaginians in the *second* place represented themselves as having "made the voyage" (Rawlinson), or as having ascertained that it could be made (Gaisford), which amounts to the same thing.

E. J. Webb.

Trewollack, Bodmin.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Albania. *B.S.G. Română* **27** (1906): 39–63. **Burileanu.**
Romînii din triunghiul Vallona-Ardenița-Berat (Albania), de C. Burileanu.

Alps—Dauphiné. *La G.* **13** (1906): 437–442. **Jacob.**
Rapport preliminaire sur les travaux glaciaires en Dauphiné pendant l'été 1905. Par Charles Jacob.

Alps—Monte Rosa. *B.S.G. Italiana* **7** (1906): 639–662. **Alessandri.**
Due mesi sulla vetta del Monte Rosa, conferenza dal dott. C. Alessandri. *With Illustrations.*

Alps—Morphology. *Vierteljahrschrift Naturf. Ges. Zürich* **51** (1906): 1–49. **Heim.**
Geologische Nachlese von A. Heim. Nr. 15. Ein Profil am Südrand der Alpen, der Pliocaenfjord der Breggiaschlucht. *With Map and Profiles.*

Alps and Pyrenees. *La G.* **13** (1906): 417–424. **Lapparent.**
Les époques glaciaires dans le massif alpin et la région pyrénéenne. Par A. de Lapparent.

Austria. *Deutsch. Rundschau G.* **28** (1906): 397–405. **Mayer.**
Die südlichsten Uebergänge vom Donau- zum Elbegebiet. Von Prof. Dr. J. Mayer. *With Maps and Illustrations.*

Austria. *Globus* **89** (1906): 152–157. **Perko.**
Die Riesengrotte bei Triest-Opcina. Von G. A. Perko. *With Plan and Illustrations.*

Austria—Bohemia. *M.K.K.G. Ges. Wien* **49** (1906): 60–73. **Schneider.**
Das Duppauer Mittelgebirge in Böhmen. Von Dr. K. Schneider.

Austria—Tirol. *B.S.G. Italiana* **7** (1906): 546–568. **Marson**
Sui ghiacciai dell' Adamello-Presanella (alto bacino del Sarca-Mincio). Nota del Prof. L. Marson. *With Map and Illustrations.*

Austria—Tirol. **Frech.**
Ueber den Gebirgsbau der Tiroler Zentralalpen, mit besonderer Rücksicht auf den Brenner. Von Fritz Frech. (*W. Ergänzh., Z. Deuts. u. Oesterr. Alpenv.* 2, Heft 1 (1905): pp. x. and 98.) *With Map, Illustrations, and Diagrams.*

Belgium. *B.S. Belge Géologie, Procès-Verb.* **20** (1906): 100–102. **Simoens.**
De l'indépendance, en Belgique, des chaînes calédonienne et hercynienne. Par G. Simoens.

Belgium—Liége. **Hertslet.**
Arms Industry of Liége. Foreign Office, Miscellaneous, No. 650. 1906. Size 10 × 6½, pp. 54. *Diagram.* *Price* 7½*d.*

Bulgaria. *Tour du Monde* **12** (1906): 241–264. **Launay.**
Les Balkans de Bulgarie. Par L. de Launay. *With Map and Illustrations.*

Corsica and Sardinia. *M.K.K.G. Ges. Wien* **49** (1906): 74–86. **Schoener.**

Corsica und Sardinien in vergleichender Darstellung. Von G. Schoener.

Denmark. *G.Z.* **12** (1906): 361–378. **Machaček.**

Dänemarks Boden und Oberfläche. Von F. Machaček. *With Illustrations.*

Europe. **Philippson.**

Europa. Zweite Aufl. des von Dr. Alfred Philippson und Prof. Dr. Ludwig Neumann verfassten Werkes, neu bearbeitet von Prof. Dr. A. Philippson. (Allgemeine Länderkunde, herausgegeben von Prof. Dr. W. Sievers.) Leipzig und Wien: Bibliographisches Institut, 1906. Size 10½ × 7¼, p. xii. and 762. *Maps and Illustrations. Price* 17*s.*

Europe—Languages. *Deutsche Erde* **4** (1905): 47–51. **Zemmrich.**

Die deutsch-romische Sprachgrenze. Von Johannes Zemmrich.

France. *B.S.G. Com. Bordeaux* **27** (1901): 129–145. **Duffart.**

Topographie ancienne et moderne des lacs d'Hourtin et de Lacanau. Par C. Duffart. *With Maps and Sections.*

France. *B.S.G. Com. Bordeaux* **29** (1906): 31–36, 61–76. **Paniagua.**

Les Landes de Gascogne et les Deltas de la Gironde. Par A. de Paniagua. *With Map.*

Italy. **Baedeker.**

Italy. Handbook for Travellers by Karl Baedeker. First Part: Northern Italy, including Leghorn, Florence, Ravenna, and Routes through Switzerland and Austria. 13th edition. Leipzig: K. Baedeker; London: Dulau & Co., 1906. Size 6½ × 4½, pp. lxiv. and 592. *Maps and Plans. Price* 8*m. Presented by Messrs. Dulau & Co.*

United Kingdom—Ireland. **Cooke.**

Handbook for Travellers in Ireland. Seventh Edition. Revised and Edited by John Cooke. London: E. Stanford, 1906. Size 7 × 5, pp. x., 58, and 576. *Maps and Plans. Price* 9*s. Presented by the Publisher.*

The sixth edition, issued in 1902, has been here subjected to a renewed revision.

United Kingdom—Isle of Wight. **Ward.**

Thorough Guide Series. The Isle of Wight, with Notes for Geologists and Cyclists. By C. S. Ward. New edition. London: Dulau & Co., 1906. Size 6½ × 4½, pp. xiv. and 86. *Maps and Plans. Price* 2*s.* 6*d. net. Presented by the Publishers.*

United Kingdom—Lake District. **Baddeley**

Thorough Guide Series. The English Lake District. By M. J. B. Baddeley. Tenth edition. London: Dulau & Co., 1906. Size 6½ × 4½, pp. xxx., 16, 248, and 20. *Maps and Panoramas. Price* 5*s. net. Presented by the Publishers.*

United Kingdom—Meteorology. **Mill.**

British Rainfall, 1905. On the Distribution of Rain in space and time over the British Isles during the year 1905. . . . By Hugh Robert Mill. London: E. Stanford, 1906. Size 9 × 5½, pp. 88 and 272. *Maps and Illustrations. Price* 10*s. Presented by Dr. H. R. Mill.*

It is pointed out that the number of stations from which returns are published at last exceeds four thousand, though the distribution of the rain-gauges over the country (graphically shown on a map) still leaves something to be desired. Except in the extreme north of England, the areas more than 10 miles from any gauge occur only in Scotland, South Wales, and Ireland.

United Kingdom—Scotland. **Baddeley.**

Thorough Guide Series. The Northern Highlands, Scotland (part ii.) . . . By M. J. B. Baddeley. 7th edition. London: Dulau & Co., 1906. Size 6½ × 5, pp. xvi. and 150. *Maps and Plans. Price* 3*s.* 6*d. net. Presented by the Publishers.*

The only fault to be found with this guide is that the general map is so inserted that it cannot be kept open while the text is being consulted.

United Kingdom—Yorkshire. **Baddeley.**

Thorough Guide Series. Yorkshire (part ii.), West and part of North Ridings and all parts of the country West of the North-East Main Line; also Barnard Castle and Teesdale. By M. J. B. Baddeley. Fifth edition, thoroughly revised. London: Dulau & Co., 1906. Size 6½ × 4½, pp. xvi. and 152. *Maps and Plans. Price* 3*s. net. Presented by the Publishers.*

A section map of Ripon and neighbourhood is added in this edition.

ASIA.

Asiatic Russia. **Tillo.**

Superficie de la Russie d'Asie, avec les bassins: des océans, des mers, des rivières et des lacs, ainsi que les superficies des divisions administratives sous le règne de l'Empereur Nicholas II. Par A. de Tillo. [In Russian.] St. Petersbourg, 1905. Size 14 × 11½, pp. xxiv., 66, 35, 101, 4, 6, 5. *Maps and Diagrams; also Map, separate. Presented by M. J. de Schokalsky.*

China. *Petermanns M.* **52** (1906): 91–92. **Lóczy.**

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Indian Records Series. Old Fort William in Bengal. A Selection of Official Documents dealing with its History. Edited by the late Dr. C. R. Wilson. 2 vols. London: J. Murray, 1906. Size 9½ × 6½, pp. (vol. 1) xl. and 256; (vol. 2) viii. and 330. *Plans and Plates. Price* 24*s. net. Presented by the Publisher.*

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Identifications in the Region of Kapilavastu. By Major W. Vost. *With Map.*

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Note sur les Crues et Inondations en 1905 (au Tonkin). Par M. Lantenois. *With Map.*

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Ts. K. Ned. Aard. Genoots. Amsterdam **23** (1906): 713–724.

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Stanford's Compendium of Geography and Travel (New Issue). Asia. Vol. 1. Northern and Eastern Asia. By A. H. Keane, LL.D. Second Edition. London: E. Stanford, 1906. Size 8 × 5½, pp. xxvi. and 528. *Maps and Illustrations. Price* 15*s*. *Presented by the Publisher.*

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Philippine Islands. **Dauncey.**

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Southern India—Anthropology. **Thurston.**

Ethnographic Notes in Southern India. By Edgar Thurston. Madras: Printed by the Superintendent, Government Press, 1906. Size 9 × 6, pp. viii. and 580. *Illustrations. Price* 6*s*. *Presented by the Government Press, Madras.*

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Tibet. **Sherring.**

Western Tibet and the British Borderland, the sacred country of Hindus and Buddhists: with an account of the Government, Religion, and Customs of its Peoples. By Charles A. Sherring. With a chapter by T. G. Longstaff, describing an attempt to climb Gurla Mandhata. London: E. Arnold, 1906. Size 10 × 6, pp. xvi. and 376. *Maps and Illustrations. Price* 21*s*. *net. Presented by the Author.*

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Rerum Aethiopicarum Scriptores Occidentales inediti a Saeculo xvi. ad xix. curante C. Beccari S.I. Vol. 4. P. Emmanuelis Barradas S.I. Tractatus Tres historico-geographici. Romae: C. de Luigi, 1906. Size 11 × 8, pp. xxxii. and 402.

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Deutsche Arbeit in Afrika 1884 bis 1905. Von Paul Langhans. *Map.*

Africa—Meteorology. *Petermanns M.* **52** (1906): 73–82. **Fraunberger.**

Studien über die jährlichen Niederschlagsmengen des afrikanischen Kontinents. Von G. Fraunberger. *With Map.*

Noticed in the Monthly Record, November, p. 507.

Africa—Political. **Sanderson.**

Great Britain in Modern Africa. By Edgar Sanderson. London: Seeley & Co., 1907 [1906]. Size 8½ × 5½, pp. iv. and 380. *Map and Portraits. Price* 5*s. Presented by the Publishers.*

A compilation, bringing together the main facts of British political relations with Africa since the beginning of the nineteenth century.

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Treaty Series. No. 4. 1906. Agreement between the United Kingdom and the Independent State of the Congo, modifying the Agreement signed at Brussels, May 12, 1894. Signed at London, May 9, 1906. London, 1906. Size 9½ × 6, pp. 4. *Price* ½*d.*

See *Journal*, vol **27**, p. 629.

Africa—Political. *Le Mouvement G.* **23** (1906): 247–250. ——

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Cape Colony—Griqualand West. **Young and Johnson.**

T. Geol. S. South Africa **9** (1906): 34–39.

Glacial Phenomena in Griqualand West. By R. B. Young and J. P. Johnson. *With Plates.*

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Cape of Good Hope. Report of the Director of Irrigation for the Two Years ending December 31, 1905. Cape Town, 1906. Size 13 × 8, pp. 86. *Plans. Presented by the Director of Irrigation, Cape Colony.*

Central Africa. **Lloyd.**

Uganda to Khartoum. Life and Adventure on the Upper Nile. By A. B. Lloyd. With a Preface by Victor Buxton. London: T. Fisher Unwin, 1906. Size 9 × 6, pp. xii. and 312. *Map and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

This is not merely the account of a journey, but the record of a lengthened residence among some of the less-known tribes of Western and Northern Uganda, about whose manners and customs it contributes a good deal that is new.

Congo State. **Lemaire.**

Mission Scientifique Congo-Nil. Résultats des observations astronomiques, magnétiques et altimétriques effectuées sur le territoire de l'État Indépendant du Congo, du Vendredi 5 Septembre 1902 au Vendredi 14 Avril, 1905. Par le Commandant Lemaire Ch. Size 13 × 10, pp. 54. *Map. Presented by the Author.*

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Gennem Landet Nord for Lutöifloden (N. Ø. f. Leopold II. Sø i Kongo). Elfter Dagbogsoptegnelser og officielle Rapporter. Af Otto J. Lund. *With Sketch-map.*

Congo State. *Mouvement G.* **23** (1906): 313–318. **[Wauters.]**

Souvenirs historiques. *With Map.*

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Notes on the Ethnography of the Ba-Mbala. By E. Torday and T. A. Joyce. *With Map and Plates.*

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From Mombasa to Khartum: through Uganda and down the Nile. By Sir C. Eliot, K.C.M.G., etc.

Eritrea. *Riv. G. Italiana* **13** (1906): 182–192. **Dainelli and Marinelli.**

Determinazioni altimetriche nella media valle dell' Anseba e negli altipiani di Molebso e di Halhal (Colonia Eritrea). Nota di G. Dainelli ed O. Marinelli.

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De Zinder au Tchad. Note de R. Chudeau.

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Von Mwansa nach Uschirombo, 29. September bis 7. Oktober 1903. Von J. M. M. Van der Burgt. *With Map.*

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A good elementary geography of the Orange River Colony.

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The Geography and Geology of Alaska, a summary of existing knowledge. By Alfred H. Brooks. With a Section on Climate, by Cleveland Abbe, Jr., and a Topographic Map and description thereof, by R. U. Goode. (U.S. Geological Survey, Professional Paper No. 45.) Washington, 1906. Size 12 × 9, pp. 328. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

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On Lapps and reindeer in Alaska.

America—Discovery. *Abréyé B.S. Hongroise G.* **34** (1906): 1–10. **Teleki.**

Japans Rolle in der Geschichte der Entdeckung Amerikas. Von Paul, Grafen Teleki. (*Földrajzi Közlemények* **34** (1906): 1–13. *With Maps.*)

Canada. *J.G.* **5** (1906): 74–77. **Dresser.**

The Monteregian Hills, a series of volcanic Buttes. By J. A. Dresser. *With Map and Illustration.*

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Das Deutschtum in Kanada. Von Alwin Oppel. *With Map.*

Canada. *Trans. R.S. Canada*, II. Ser. **11**, 1905 (1906): Section II., 99–119. **Sulte.**

Origin of the French Canadians. By B. Sulte. *With Map.*

Canada—Bibliography. **Dionne.**

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Inventaire chronologique des ouvrages publiés à l'étranger dans diverses langues sur la Nouvelle-France et sur la Province de Québec, depuis la découverte du Canada jusqu'à nos jours, 1534–1906. Par Dr. N.-E. Dionne.

Canada—Census.

Fourth Census of Canada, 1901. Vol. 4. Vital Statistics, School Attendance, Educational Status, Dwellings and Families, Institutions, Churches, and Schools, Electoral Districts and Representation. Ottawa, 1906. Size 10 × 7, pp. 468.

Canada—Geodesy. *Proc. R.S. Canada*, II. Ser., **11**, 1905 (1906): xcvii.–xcviii. **McLeod.**

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Some Interesting Problems in New Brunswick Geology. By Dr. R. W. Ells.

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Mexico. **George.**

Das heutige Mexiko und seine Kulturfortschritte. Von P. George. Beiheft zu den Mitteilungen der Geographischen Gesellschaft (für Thüringen) zu Jena. Jena: G. Fischer, 1906. Size 9½ × 6, pp. 134. *Illustrations.*

Mexico—El Carmen. **Acevedo.**

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Mexico—Maps. *B. American G.S.* **38** (1906): 281–287. **Merrill.**
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On the Origin of the Small Mounds of the Lower Mississippi Valley and Texas. By R. T. Hill.

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Eine Pilcomayo-Reise in den Chaco Central. Von V. Frič. *With Map and Illustrations.*

Argentine—Buenos Ayres. *B.I.G. Argentino* **22** (Part 2): 43–57. **Morales.**
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Argentine—Patagonia. *C.R.A. Sc.* **142** (1906): 1392–1394. **Gaudry.**
Fossiles de Patagonie. Étude sur une portion du monde antarctique. Par Albert Gaudry.

Bolivia—Andes. *Appalachia* **11** (1906): 95–110. **Peck.**
Climbing Mount Sorata. By Annie S. Peck. *With Illustrations.*

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The Chorotes Indians in the Bolivian Chaco. By Count Eric von Rosen. *Illustrations.*

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K. Svenska Vetenskaps-A. Handlinger **37** (1903): No. 4 (pp. 30).
Ueber die Säugetierfossilien des Tarijatals, Südamerika. I. Mastodon Andium Cuv. Von Erland Nordenskiöld. *With Plates.*

Brazil. *B.S.R.G. d'Anvers* **29**, 1905 (1906): 421–464. **Georlette.**
Les travaux de transformation de la ville de Rio de Janeiro et de construction du port. Par F. A. Georlette. *With Maps.*

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Ueber das natürliche Vorkommen von Nephrit in Brasilien. Von H. von Ihering.

Brazil—Amazon. **Edmundson.**
Early Relations of the Mauvas with the Dutch, 1606-1732. By Rev. George Edmundson. [From the *English Historical Review*, April, 1906.] Size 10 × 6, pp. [25]. *Presented by the Author.*

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A travers le Peten et le Yucatan. Par Le Comte Maurice de Périgny.

Chile—Strait of Magellan. *Petermanns M.* **52** (1906): 139–140. **Stange.**
Die Erforschung der Magellanstrasse. Von P. Stange. *With Map.*
On the work of the Chilian navy during the past half-century.

Colombia. **Petre.**
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Australia—Transport. *Deutsch. G. Blätter* **29** (1906): 61–153. **Gast.**

Zur Entwicklung der Verkehrswege des australischen Kontinents. Von M. Gast. *With Map.*

Midway Island. **Bryan.**

Bernice Pauahi Bishop Museum, Director's Rep., 1905: 37–45.

Report of a Visit to Midway Island. By W. A. Bryan. *With Map.*

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Een verkenningsreis der Zuidwestkust van Nieuw-Guinea, van straat Prinses Marianne tot de Providentiaal-bank; dd. 23 April—8 Mei 1906. Door J. H. Hondius van Herwerden. *With Map and Illustrations.*

New Guinea. **Van der Meulen.**

Ts. K. Ned. Aard. Genoots. Amsterdam **23** (1906): 732–734.

Ontdekkingen in Zuidelijk Nieuw-Guinea. Door J. C. Van der Meulen.

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Baining, Land und Leute.

POLAR REGIONS.

Antarctic. **[Brown, Mossman, and Pirie.]**

The Voyage of the *Scotia*. Being the Record of a Voyage of Exploration in Antarctic Seas. By three of the Staff. [R. N. Rudmose Brown, R. C. Mossman, and J. H. Harvey Pirie.] Edinburgh and London: W. Blackwood & Sons, 1906. Size 9 × 6, pp. xxiv. and 376. *Maps and Illustrations. Price* 21*s. net. Presented by the Publishers.* [To be reviewed.]

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The Area of Unknown Antarctic Regions compared with Australia, Unknown Arctic Regions, and British Isles. By W. S. Bruce. *With Map.*

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Die Bewegung des antarktischen Inlandeises. Von E. von Drygalski. *With Illustration.*

Antarctic—Exploration. **Lapparent.**

L'Épopée Antarctique. Par A. de Lapparent. (From the *Journal des Savants*, Paris, 4ᵉ Année, 1906, Nos. 4–5, Avril–Mai.) Size 11 × 9, pp. [25].

Antarctic—Graham's Land. *C. Rd.* **143** (1906): 178–180. **Gourdon.**

Les roches microlitiques de la Terre de Graham recueillies par l'expédition antarctique du Dr. Charcot. Note de E. Gourdon.

Greenland. *G. Ts.* **18** (1905–06): 195–199. **Mylius-Erichsen.**

Plan til en dansk Skibs- og Slædeekspedition til Grønlands Nordostkyst. Af L. Mylius-Erichsen.

MATHEMATICAL GEOGRAPHY.

Cartography. *Petermanns M.* **52** (1906): 97–109. **Eckert.**

Neue Entwürfe für Erdkarten. Von Dr. Max Eckert. *With Diagrams.*

Suggests various new forms of map-projections, some of them bearing a general resemblance to those used by Ortelius and others in the sixteenth century. The mathematical formulæ are fully worked out.

Cartography—Projection. *Petermanns M.* **52** (1906): 92–94. **Hammer.**

Ein neuer Vorschlag für den Netzentwurf topographischer Karten. Von Prof. Dr. E. Hammer.

Account of a projection proposed by Herr F. J. Müller, which, however, is rather of theoretic interest than practical importance.

Navigation—Instruments. **Kohlschütter.**

Ueber die neuere Entwicklung der nautischen Instrumente. Von Dr. E. Kohlschütter. (Sonderabdruck aus: "Deutsche Mechaniker-Zeitung," 1906, Nr. 1.) Berlin: J. Springer. Size 10½ × 8, pp. 31. *Illustrations.*

Photographic Surveying. *C. Rd.* **142** (1906): 1313–1318. **Laussedat.**

Sur plusieurs tentatives poursuivies dans la marine allemande pour utiliser la photographie dans les voyages d'exploration. Note de A. Laussedat. *With Illustration.*

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A Case of Isolation without "Barriers." By Dr. A. E. Ortmann.

Climate—Snow-line. *Vierteljahrschrift Naturf. Ges. Zürich* **51** (1906): 30–54. **Brückner.**

Die Höhe der Firnlinie am Hüfigletscher und die Methode der Bestimmung der Hohe der Firnlinie im allgemeinen. Von E. Brückner.

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Relative geological importance of Continental, Littoral, and Marine Sedimentation. By J. Barrell.

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Sur la rapidité de l'érosion torrentielle. Note de M. E. A. Martel.

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Note sur la valeur de l'érosion souterraine par l'action des sources. Par Prof. H. Schardt.

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Contribution à l'étude de l'érosion chimique souterraine. Par E. Van den Broeck.

Forests and Rainfall. *Monthly Weather Rev.* **34** (1906): 24–26. **Hubbard.**

The relation of forests to rainfall. By the late W. F. Hubbard. *With Map.*

The map embraces part of the Pacific slope of the United States, and shows in a striking way the relation between the distribution of forests and the lines of equal annual precipitation.

Geological History. *Scottish G. Mag.* **22** (1906): 397–407. **Geikie.**

From the Ice Age to the Present. By Prof. James Geikie, F.R.S.

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Essai de Comparaison entre la série glaciaire du Professeur A. Penck et les divisions du Tertiare supérieur et du Quaternaire de la Belgique et du Nord de la France. Par A. Rutot.

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Aids in Practical Geology. By Grenville A. J. Cole. 5th edition. London: C. Griffin & Co., 1906. Size 8 × 5½, pp. xvi. and 432. *Illustrations. Price* 10*s.* 6*d. Presented by the Publishers.*

One of the many good text-books on field geology that have appeared within recent years. It does not, however, greatly concern the geographer, having to do rather with rocks, minerals, and fossils than with the structural and morphological side of geology.

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Ancient Geography. **Klotz.**

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Landschafts-, Wirtschafts-, Gesellschafts-, Kulturtypen. Geographische Skizzen Von Dr. L. Chalikiopoulos. Leipzig: B. G. Teubner, 1906. Size 10½ × 7, pp. x. and 112. *Presented by the Publisher.* [To be reviewed.]

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Beziehungen zwischen Pflanzengeographie und Siedlungsgeschichte. Von R. Gradmann.

Anthropogeography. **Kirchhoff.**

Man and Earth. The reciprocal relations and influences of Man and his environ-

ment. By Alfred Kirchhoff. London: G. Routledge & Sons, [1906]. Size 6½ × 4, pp. 224. *Price* 1*s. net. Presented by the Publishers.*

A translation of the author's well-known and deservedly popular work 'Mensch und Erde,' with the addition of a chapter by him on the British Isles, and one on America by the translator.

Anthropogeography. **Protheroe.**

The Dominion of Man: Geography in its Human Aspect. By Ernest Protheroe. London: Methuen & Co., [1906]. Size 8 × 5, pp. xii. and 216. *Illustrations. Price* 2*s. Presented by the Publishers.*

An instructive account of man and his activities from the geographical standpoint, likely to be useful as an introduction to the subject in schools.

Anthropology—Catalogue. ———

International Catalogue of Scientific Literature. Fourth Annual Issue. P. Anthropology. London: Harrison & Sons, 1906. Size 8½ × 5½, pp. viii. and 412. *Price* 15*s.*

Commercial. **Vasconcellos.**

Sociedade de Geographia de Lisboa, Exposição Colonial de Algodão, Borracha, Cacau e Café (Abril a maio de 1906). Catalogo sob a direcção de Ernesto de Vasconcellos. Lisboa, 1906. Size 9 × 6, pp. xxiv. and 104. *Presented by the Author.*

Commercial Geography. **Johnson.**

Ocean and Inland Water Transportation. By E. R. Johnson, PH.D. London: Sidney Appleton, 1906. Size 8 × 5½, pp. xxii. and 396. *Maps and Illustrations. Price* 6*s. net. Presented by the Publisher.* [To be reviewed.]

Historical—Ibn Jobair. **Schiaparelli.**

Ibn Gubayr (Ibn Giobeir), Viaggio in Ispagna, Sicilia, Siria e Palestina, Mesopotamia, Arabia, Egitto, compiuto nel secolo xii. Prima traduzione, fatta sull' originale Arabo da C. Schiaparelli. Roma: E. Loescher & Co., 1906. Size 10 × 6½, pp. xxviii. and 412. *Price* L10. *Presented by the Publishers.*

[To be reviewed.]

BIOGRAPHY.

La Vérendrye. **Prud'homme.**

Trans. R.S. Canada, II. Ser., **11**, 1905 (1906): *Section I.*, 9–57.

Pierre Gaultier de Varennes, Sieur de la Vérendrye, Capitaine des troupes de la Marine, Chevalier de l'Ordre Militaire de Saint Louis, Découvreur du Nord-Ouest, 1685–1749. Par L. A. Prud'homme.

Martius. **Goebel.**

Zur Erinnerung an P. K. Ph. v. Martius. Gedächtnisrede bei Enthüllung seiner Buste im K. Botanischen Garten in München am 9. Juni 1905. Von K. Goebel. München, 1905. Size 11 × 8½, pp. 20.

Minutilli. *B.S.G. Italiana* **7** (1906): 589–590. **Millosevich.**

Federico Minutilli, necrologio di E. Millosevich.

Shaler. *Science* **23** (1906): 869–872. ———

Nathaniel Southgate Shaler.

Zittel. **Rothpletz.**

Gedächtnisrede auf Karl Alfred von Zittel gehalten in der öffentlichen Sitzung der K. B. Akademie der Wissenschaften zu München zur Feier ihres 146. Stiftungstages am 15. März 1905. Von August Rothpletz. München, 1905. Size 11 × 8½, pp. 24.

GENERAL.

Educational. **Bertrand.**

La Géographie à l'école et les bases d'un système rationnel d'enseignement. Par Jean Bertrand. Bruxelles: F. Larcier, 1906. Size 9½ × 6, pp. 122. *Price* 2 *fr. Presented by the Publisher.*

Educational. **Kirchhoff and Günther.**

Didaktik und Methodik des Geographie-Unterrichts (Erdkunde und mathematische Geographie). Von Dr. A. Kirchhoff und Dr. S. Günther. Zweite Auflage. München: C. H. Beck, 1906. Size 10 × 6½, pp. vi., 68, and 48. *Maps. Presented by Dr. A. Kirchhoff.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from October 1 to 31, 1906.

2 miles to 1 inch:—

Large Series, printed in colours, folded in cover or flat in sheets, 29, 33. *Price, on paper*, 1*s.* 6*d.*; *mounted on linen*, 2*s.*; *mounted in sections*, 2*s.* 6*d. each.*

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With hills in brown or black, 44, 185, 203, 224, 225, 233, 297. 1*s. each* (engraved). Printed in colours, folded in cover or flat in sheets, 96, 185. *Price, on paper*, 1*s.*; *mounted on linen*, 1*s.* 6*d.*; *mounted in sections*, 2*s. each.*

6-inch—County Maps (first revision):—

Brecknockshire, 25 N.E., S.E., 37 N.W. **Cardiganshire**, 14 N.E., 16 N.E., 17 S.W., 21 S.E., 26 N.W., 27 S.W., 32 S.E., 33 N.W., S.E., 34 N.W., S.W., 35 S.W., 39 S.W., S.E., 40 N.E., S.W., 41 N.W., N.E., S.W., 42 N.W., 43 N.W., 47 N.W. **Carmarthenshire**, 1 S.W., 2 S.W., 5 S.W., 7 N.E., S.W., 8 N.W., 10 N.W., 15 N.W., 27 N.E., S.E., 43 N.W. **Devonshire**, 12 N.W., 41 N.E., 42 N.E., 48*a* S.W., 52 N.W., S.E., 53 N.W., S.W., S.E., 60 S.E., 60*a* S.W., 64 S.E., 65 N.E., S.E., 77 N.W., N.E., S.W., 78 S.W., 80 N.W., 88 N.W., 98 N.E., 99 S.E., 101 S.W., 106 N.E., S.E., 107 N.E., S.W., S.E., 108 S.W., 109 S.W., 110 N.W., N.E., S.W., S.E., 112 N.E., 114 N.W., N.E., S.W., S.E., 115 S.E. **Lincolnshire**, 60 N.W., S.E., 64 N.W., 71 N.E., S.E., 72 N.W., N.E., 73 N.W., 74 N.E., 80 N.E., S.W., 81 N.W., N.E., S.E., 82 N.W., S.W., 83 N.W., 88 S.E., 91 S.E., 92 N.E., S.W., 97 S.E., 98 N.W., N.E., S.W., 99 N.W., 100 S.E., 101 N.W. **Norfolk**, 8 S.W., 9 N.W., 14 N.W., N.E., S.E., 15 N.W., N.E., S.W., 23 N.W., S.W., 24 S.W., 25 S.W., 32 N.E., 35 N.W., S.E., 48 S.W., 58 S.E., 59 S.E., 60 N.E., 69 N.W., 71 S.E., 78 S.W., 80 N.E., 81 N.W., S.E., 83 N.E., 85 S.W. **Suffolk**, 2 S.W., 4 N.W. **Yorkshire** (First Revision of 1891 Survey), 272 S.E., 273 S.W., 281 N.W., N.E., 282 N.W. 1*s. each.*

25-inch—County Maps (first revision):—

Carmarthenshire, XXXVIII. 15; XLI. 16; XLIV. 16; XLV. 1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 13, 14, 16; XLVI. 5, 6, 7, 8, 9, 10, 11, 12, 14, 15; XLVII. 5, 7, 9; XLVIII. 1, 2, 3, 4, 6; XLIX. 1, 2, 3; LII. 1, 2; LIII. 2, 3, 5, 11. **Cornwall**, XV. 15; XVI. 3, 8, 9; XXI. 1, 3, 4, 5, 6, 7, 9, 10, 11, 12; XXII. 1, 5, 7, 8, 9, 16; XXIII. 2, 6, 7, 11; XXVIII. 3, 6, 8; XXIX. 1, 3, 7, 10, 11. **Devonshire**, LXXXVI. 15; XCVI. 16. 3*s. each.* LXXXVI. 14; XCVI. 3, 7, 15. 1*s.* 6*d. each.* **Lincolnshire**, XXXV. 4, 6, 7, 8, 10, 11, 12, 14, 15, 16; XXXVI. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16; XXXVII. 1, 10, 11; XXXVIII. 3, 5, 6, 7, 9, 10, 11, 13, 15, 16; XLIV. 11; XLVII. 16; XLVIII. 1, 5, 7, 8, 10, 13; XLIX. 1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16. **Norfolk**, XIX. 3; XX. 16; XXIX. 5, 6, 9, 10, 11, 12, 15; XXX. 15; XXXIX. 4, 8, 12, 16; XL. 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XLI. 1, 2, 4, 5, 6, 8, 10, 11, 12, 13, 14, 15, 16; XLII. (1 and 5), 9, (10 and 14), 13, (14 and 10); LI. 4, 8, 12; LII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; LIV. 9, 13; LXV. 3, 4; LXVI. 1; LXXXVII. 7, 10; XCI*a*. 2. **Yorkshire**, CCXXXVIII. 16; CCXXXVIII*a*. 9; CCLII. 5, 10, 11, 12, 13, 14, 15, 16; CCLVIII. 12, 16; CCLIX. 3, 6, 7, 8, 10, 12, 13, 14, 15; CCLX. 5, 9, 10, 13, 14; CCLXI. 2. 3*s. each.*

(*E. Stanford, London Agent.*)

England and Wales. **Railway Clearing House.**

Official railway map of England and Wales prepared at the Railway Clearing House. Scale 1 : 475,200 or 1 inch to 7·5 stat. miles. 4 sheets. London: Railway Clearing House, 1906.

France. **Ministère des Travaux Publics.**

Carte géologique de la France. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. 4 sheets. Paris: Ministère des Travaux Publics, 1905. *Price* 9 *fr.* 50.

Germany. **K. Preussische Landesaufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographischen Abteilung der Königlichen Preussische Landesaufnahme. Scale 1 : 100,000 or 1 inch to 1·6 stat. miles. Sheets: (coloured) 297, Zielenzig; 345, Sommerfeld. Berlin: K. Preussische Landesaufnahme, 1906. *Price* 1.50 *marks each sheet.*

London. **Bartholomew.**

Road Surface Map of London and Neighbourhood. Scale 1 : 31,680 or 2 inches to one stat. mile. Revised by the Cyclists' Touring Club. Edinburgh : John Bartholomew & Co., 1906. *Price, mounted on cloth, 2s. 6d.*

Shows, by different colours, the material of which the surface of the roads is constructed in London and near suburbs.

Luxemburg. **Hansen.**

Carte topographique du Grand-Duché de Luxembourg. Par J. Hansen. Scale 1 : 50,000 or 1·3 inch to a stat. mile. Sheets: 10, Capellen; 11, Luxembourg; 12, Grevenmacher. Paris: Erhard Frères, [1906].

Russia. **Petri and Schokalsky.**

Carte de la Russie d'Europe tirée du Grand Atlas de Marcks. Commencée par M. le professeur E. Petri, et achevée et rédigée par **M. J.** de Schokalsky. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. 16 sheets. St. Petersburg: A. F. Marcks, 1905. [In Russian.] *Presented by M. J. de Schokalsky.*

Russia. **Peucker.**

Politische Uebersichtskarte des europäischen Russland. Bearbeitet von Dr. Karl Peucker. Scale 1 : 6,000,000 or 1 inch to 94·7 stat. miles. Vienna: Artaria & Co., 1906. *Presented by the Publisher.*

Russia. **Peucker.**

General- und Strassenkarte von Westrussland nebst den Oesterreichisch- Ungarischen und Deutschen Grenzgebieten. Bearbeitet von Dr. Karl Peucker. Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. Third edition. Vienna : Artaria & Co., 1906. *Presented by the Publisher.*

Sweden. **Swedish General Staff.**

Järnvags- och Postkarta öfver Sverige. Scale 1 : 800,000 or 1 inch to 12·6 stat. miles. 2 sheets. Stockholm: Topographical Section, General Staff, 1906. *Presented by the Director, Swedish General Staff.*

This map shows railways, roads, post stations, and other information connected with means of communication in Sweden, and should be specially useful to tourists. It is printed in colours, and is without hill shading. The information given has been corrected up to July 1, 1906.

ASIA.

Asia. **Stanford and Mackinder.**

Stanford's New Orographical Map of Asia. Compiled under the direction of H. J. Mackinder, M.A. Scale 1 : 8,721,500 or 1 inch to 137·6 stat. miles. 4 sheets. London : Edward Stanford, 1906. *Price* 16*s. Presented by the Publisher.*

In general appearance and arrangement of colours this map is similar to others of the series to which it belongs. One great improvement upon many other orographical maps is the fact that only shades of one colour—brown—are used to represent the heights, so that the eye readily follows the graduations without the unnecessary and meaningless abrupt break from a dark green to a light brown which frequently occurs. The names, as before, are printed in a grey, so as not to spoil the graphic effect of the tinting, and this arrangement is most successful until the darkest shades are reached, where, owing to their faintness, the names become almost illegible. The dark tints, which occur principally over the plateau of Tibet, are perhaps somewhat unnecessarily dark, and if they had been a little lighter they would still have been sufficiently distinctive, and have rendered it possible to read the names clearly. However, the map, like the rest of the series, which is being produced under the direction of Mr. H. J. Mackinder, has much to commend it, and will doubtless be welcomed by educational establishments where geography is taught on the more enlightened and intelligent system.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 1 inch to 4 miles. Sheets: 63, parts of district Tinnevelly and Travancore State (Madras Presidency), additions to 1904. 67 s.w., parts of districts Bareilly, Budaun, Aligarh, Etah, Moradabad, Bulandshahr, Shahjahanpur, and of Rampur State (U.P. of Agra and Oudh), additions to 1904. 80 s.w., parts of districts Madura, Tanjore, and Tinnevelly (Madras Presidency), 1906.—India and Adjacent Countries, 1 : 1,000,000. Sheet 70, parts of Tibet and Eastern Turkestan. 1906.—Northern Trans-Frontier Survey, 1 inch to 2 miles. Sheet 47, part of Kashmir, Season 1899, 1906.—North-Western Trans-Frontier Survey, 1 inch to 2 miles. Sheets: 431, parts of Afghanistan, Mohmand country, Dir and Swat

Agency (N.W.F. Province), Seasons 1894–1898, 1905; 457, parts of districts Mianwali (Punjab), Dera Ismail Khan, and Frontier State of Waziristan (N.W.F. Province), Seasons 1873–77, 1883–84, 1889–91, 1903; 458, parts of districts Dera Ismail Khan, Waziristan (N.W.F. Province), Dera Ghazi Khan, Mianwali (Punjab), and Baluchistan, Seasons 1873–76, 1880–81, 1884–85, 1890–91, 1903.—North-Eastern Frontier Survey, 1 inch to 8 miles. Sheet 23, parts of districts Bhamo, Katha, Upper Chindwin, Myitkyina, Ruby Mines, Shan State of Möng Mit (Burma), and Yün-nan (China), 1906.—South-Western Asia Survey, 1 inch to 4 miles. Sheets: 73 N.E., part of Persia (Fars), Season 1901–02, 1905; 89 S.E., part of Persia (Laristan), Season 1901–02, 1906.—Eastern Bengal and Assam Survey, 1 inch to a mile. Sheets: 57, parts of districts Sylhet and Cachar, Seasons 1879–81, 1892–93, 1898–99, 1903–04, 1906; 425, parts of districts Chittagong (E.B. and Assam) and Akyab (Burma), Seasons 1885–86, 1888–93, 1905.—Bengal Survey, 1 inch to a mile. Sheets: 17 and 18, parts of districts Mirzapur (U.P.) and Palaman (Bengal), Seasons 1868–69, 1884–86, 1906; 142, parts of districts Muzaffarpur and Darbhanga, Seasons 1893–95, 1897–1900, 1906; 180, parts of districts Hazaribagh and Manbhum, Seasons 1861–62, 1869–70, 1906; 199 and 200, parts of district Darbhanga, Seasons 1895–96, 1899–1900, 1906; 259, parts of districts Birbhum, Murshidabad, Sonthal Parganas, and Burdwan, Seasons 1850–52, 1854–56, 1906; 286, districts of Hooghly, Howrah, Burdwan; 24 Parganas and Nadia, Seasons 1849–57, 1869–72, 1905.—Gaya district, 1 inch to 4 miles; 1906.—Muzaffarpur district, 1 inch to 8 miles; 1902.—Bhagalpur district, 1 inch to a mile. Sheets: 5 and 5*a*, 1890; 15, 1889; 16, 1902.—Bombay Survey, 1 inch to a mile. Sheets: 153, parts of district Broach, and States Baroda and Rajpipla (Rewa Kantha Agency), Seasons 1875–76, 1906; 197, parts of districts Poona and Kolaba, Season 1877–78, 1901; 256, parts of districts Nasik and Khandesh, Seasons 1874–76, 1882–83, 1906; 281, parts of districts North Kanara (Bombay) and Shimoga (Mysore), Season 1898–1900, 1905.—Cutch, 1 inch to 8 miles, 1906.—Burma Survey, 1 inch to a mile. Sheets: 1, parts of districts Chittagong (E.B. and Assam) and Akyab (Burma), Seasons, 1885–86, 1888–93, 1905; 151, parts of districts Myingyan and Pakôkku, Seasons 1894–96, 1902–03, 1906; 199, parts of districts Myingyan and Meiktila, Seasons 1893–94, 1902–03, 1906; 212, parts of districts Henzada and Tharrawaddy, Seasons 1880–84, 1890–91, 1902–03, 1906.—Central India and Rajputana Survey, 1 inch to a mile. Sheet 412, parts of districts Jalaun (U.P.) and Gwalior (C.I. Agency), Seasons 1852–55, 1862–63, 1906.—Central Provinces Survey, 1 inch to a mile. Sheet 159, parts of districts Balaghat, Bilaspur, Drug and Mandla, and Kawarda State, Season 1873–75, 1906.—Madras Survey, 1 inch to a mile. Sheets: 1, parts of districts North Kanara (Bombay) and Shimoga (Mysore), Season 1898–1900, 1905; 42, parts of district Chitaldroog (Mysore), Season 1882–83, 1906; 43, parts of districts Chitaldroog and Shimoga (Mysore), Season 1881–82, 1906.—North-Western Frontier Province, 1 inch to 4 miles; 1905.—Punjab Survey, 1 inch to a mile. Sheets: 60, parts of district Dera Ismail Khan (N.W.F. Province) and Mianwali (Punjab), Seasons 1874–75, 1878–80, 1906; 61 and 63, part of district Mianwali, Season 1873–75, 1879–80, 1906; 64, parts of districts Mianwali and Muzaffargarh, Season, 1873–74, 1881–82, 1906; 95, part of district Multan (Bari Doab), Season 1902–04, 1906; 135, parts of districts Attock, Rawalpindi (Punjab), Hazara, and Peshawar (N.W.F. Province), Seasons 1853–55, 1865–69, 1906; 263, part of Kangra district and Chamba State, Season 1895–99, 1905.—Mianwali district, 1 inch to 4 miles, 1906.—Sind Survey, 1 inch to a mile. Sheets: 36, district Karachi, Seasons 1904–05, 1906; 45, 48, and 49, districts Karachi and Hyderabad, Seasons 1893–94, 1903–04, 1905; 65, parts of districts Hyderabad, Thar and Parkar and Khairpur State, Season 1901–04, 1906; 81, district Sukkur, Season 1901–02, 1905.—United Provinces Survey, 1 inch to a mile. Sheets: 200 and 201, parts of districts Mirzapur (U.P.) and Palaman (Bengal), Seasons 1868–69, 1884–86, 1906.—Etawah district, 1 inch to 8 miles, 1905.—Hardoi district, 1 inch to 8 miles, 1905.—Muttra district, 1 inch to 4 miles, 1906.—Map of Yun-nan, 1: 1,000,000, 2 sheets, 1905. Calcutta: Survey of India Office. *Presented by the Secretary of State for India in Council.*

Malay Peninsula. **Stanford.**

A map of the Malay Peninsula. Scale 1: 1,140,480 or 1 inch to 18 stat. miles. London: Edward Stanford, 1906. *Price* 3*s.*

A general map of an outline character. The Native States under British protection are tinted in pale pink, and separated by narrow red boundary-lines. British possessions are shown by a darker tint of pink. The map shows railways open, under construction, and surveyed, also roads and bridle paths.

Syria. **Huber.**

Carte de la Province du Liban publiée sous le patronage de la Société Orientale de Munich. Par H. Huber. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. 4 sheets. Cairo: Baader & Gross.

The author has constructed this map from route surveys and traverses hitherto unpublished, and which extend through the greater part of the Lebanon province; thus, although rough in appearance, it is important as containing fresh information. The names of places are in French and Turkish. The map includes the country bordering on the Mediterranean from Tripoli to Saïda; it also shows the railway to Damascus.

AFRICA.

Africa. **Topographical Section General Staff.**

Map of Africa. Compiled in the Topographical Section, General Staff. Scale 1 : 1,000,000 or 1 inch to 15·8 stat. miles. Sheet 72, Kumase. London: Topographical Section, General Staff, War Office, 1906. *Price 2s. Presented by the Director of Military Operations.*

Cairo. **Stanford.**

Map of Cairo. Scale 1 : 12,000 or 1 inch to 300 yards. London: Edward Stanford, 1906. *Presented by the Publisher.*

Egypt. **Egyptian Survey Department.**

Topographical map of a portion of the Eastern Desert of Egypt. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheets: 12 H, 14 E, 15 G. Giza: Survey Department, 1906. *Presented by the Director-General, Survey Department, Giza.*

Kamerun. **Moisel.**

Provisorische Ausgabe der Karte des südlichen Teiles von Kamerun. Bearbeitet von M. Moisel. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. 3 sheets. Berlin: Dietrich Reimer (Ernst Vohsen), [1906]. *Presented by Herr M. Moisel.*

This is a provisional publication only. It is based upon the survey work of the German South Kamerun Boundary Expedition of 1901–1903, carried out by Captain Engelhardt and others, together with hitherto unpublished material. The whole has been carefully collected and combined with the surveys and traverses of earlier expeditions, so that a fairly complete map of the region is the result. It contains much detail, but no attempt at hill shading is made in this issue. One praiseworthy feature is the complete list which is given of the authorities whose maps and route surveys have here been utilized for the first time. Reference is also made to the latitude and longitude observations taken on the South Kamerun Boundary Expedition, but it would have been an advantage if a list of these determinations had been given.

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 167, Bad Hills, revised to August 31, 1906; 271, Mossy Portage, revised to August 31, 1906; 318, Sheet River, revised to August 14, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Canadian Department of the Interior.*

Canada. **Topographical Section, General Staff.**

Topographic map of Canada. Scale 1 : 63,360 or 1 inch to 1 stat. mile. Ontario. Sheet 5, Dunnville. London: Topographical Section, General Staff, War Office, 1906. *Presented by the Director of Military Operations.*

Chile. **Oficina de Limites, Santiago.**

Comision Chilena de Limites. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheet, Llanquihue. Santiago: Oficina de Limites, [1906]. *Presented by the Director, Oficina de Limites, Santiago.*

An additional sheet in continuation of those mentioned in the *Geographical Journal* for November, 1905. It includes the Southern Andine region between 44° and 45° S. lat., and 70° 40′ and 72° 40′ W. long. The topographical sheet is accompanied by a diagram showing the triangulation and traverse lines of the survey. The newly demarcated boundary-line between Argentina and Chili is shown in red. In addition to the Chilian surveys, those of the Argentine Boundary Commission have been utilized to complete the sheet, as well as other survey work. It is printed in colours.

Mexico. **Bohmer.**

Mapa del Estado de Senora y del Territorio de la Baja California, Republica

Mexicana. Dibujado por Max. Bohmer. Scale 1 : 750,000 or 1 inch to 11·8 stat. miles. Hermosillo, 1906.

A large general map of the states of Sonora and Lower California, containing a great deal of detail. The number of place-names is unusually large, in addition to which the character, size, and relative importance of the town or village is indicated by the symbol employed to represent it. In addition to the principal map, numerous insets are given, as well as tables of the population of the principal towns. No attempt has been made to represent relief, the names only of the various mountain ranges being given. A table is added, giving a list of the material used in the compilation of the map. Although only in outline, it is certainly the best map of these states for general reference that has been published so far.

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, commercial conditions, and economic statistics of the countries of the World. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.G.S., F.R.S.E. Parts 11, 12, and 13. London: George Newnes, Limited, [1906]. *Price 6d. each part. Presented by the Publisher.*

With Part 11, half of the complete issue of the twenty-two parts of which this atlas is to consist, has been published, and in this part the interesting and useful list of Commodities of Commerce is brought to an end. This list alone forms a valuable contribution in commercial geography. The other contents of this part are—Plates: 69, Potatoes and manioc; 70, 71, Maize and oats; 72, Rice and rye; 105, 108, Fisheries, statistics; 106, 107, Fisheries distribution. With this part also commences an important article entitled "Development of New Lands," in which the commercial possibilities, natural products, minerals, climate, etc., of little developed regions of the Earth are dealt with.—Part 12 commences with the first part of "An Introduction to Economic Geography," by Mr. G. G. Chisholm, M.A., B.SC., than whom no more competent authority on this subject could be found. After this follows Plates: 73, Rice and rye statistics; 74, 75, 76, Barley, millet, sago; 93, Beer and spirits production; 94, 95, 96, Coco and spices.—Part 13 first contains a continuation of Mr. G. G. Chisholm's "Introduction to Economic Geography," and plates of maps and diagrams as follows: 117 to 120, Flax, hemp, and jute supply and statistics; 149 to 151, Precious stones; 152, Petroleum, asphalt.

World. **Harmsworth.**

Harmsworth Atlas and Gazetteer. 500 maps and diagrams, and gazetteer of 105,000 references. Part i., containing plates: 11–12, the Atlantic Ocean; 13–14, Europe; 25–26, the East of England; 45–46, France and the Low Countries; 103–104, the Near East. Part ii., containing plates: 3–4, the British Empire; 133–134, Africa; 155–156, Industrial North America. London: The Amalgamated Press, Limited, 1906. *Price 7d. each part. Presented by the Publisher.*

This atlas will be specially noticed when it is completed.

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas, 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einen alphabetischen Verzeichnis aller im Atlas vorkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Austalt in Gotha. Lieferungen 23, 24, 25, and 26. Gotha: Justus Perthes, 1906. *Price 60 pf. each part.*

Parts xxiii. and xxiv. (in one cover) contains the following maps: 26, Frankreich, general, 1 : 3,700,000; 46, Europäisches Russland, sheet 3, 1 : 3,700,000; 55, Asien, general, 1 : 30,000,000; 92, Mexico, Guatemala and Salvador, 1 : 7,500,000. Parts xxiv. and xxv. (in one cover) contain maps 19, Oesterreich-Ungarn, 1 : 1,500,000, sheet 3; 33, Pyrenäische Halbinsel, 1 : 1,500,000, sheet 2; 63, Vorder-Indien und Inner-Asien, 1 : 7,500,000, sheet 4. These maps are much as they appeared in the last issue; in fact, in some respects they are hardly revised as thoroughly as they might have been, as will be seen from the map of Asia, in which Major Ryder's recent survey of the course of the Brahmaputra has not been taken advantage of. In addition to the maps there is a continuation of the Index to place-names.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during September, 1906. *Presented by the Hydrographer, Admiralty.*

No.	Inches.	
3584 m	1·1 1·1 1·8 4·1	West Indies:—channels and anchorages in the Great Bahama bank, Man of War channel, Cays south-east of Andros island, Washerwoman's cut. 3*s*.
3587 m	3·75	West Indies:—Haiti, Fort Liberté bay. 2*s*.
3589 m	0·68	Chile:—Guaitecas islands. 2*s*.
3592 m	5·0	Siam:—Bangkok harbour. 2*s*.
3585 m	1·99	China, north-east coast:—Approaches to the Wusung river. 3*s*.
3575 m	1·97 1·94	Japan:—Plans on the west coast of Nipon, Futami Wan, Aikawa Wan. 2*s*.

New Plans and Plans added.

2291 m	3·4	Norway, sheet ii.:—Bergen to Stav fiord. New plan:—Lerdalsören. 3*s*.
219 m	1·8	Malacca strait:—Acheh head to Diamond point. Plan added:—Gighen road. 3*s*.
2284 m	2·4 7·2	Plans of anchorages on the west coast of Sumatra. Plans added:—Singkel road, Singkel creek. 2*s*.
2718 m	2·9 2·1 2·9	Anchorages on the east coast of the Celebes. New plans:—Tomini road, Togean anchorage. Plan added:—Lambunu road. 2*s*.
2196 m	1·45	Sketch-plans of anchorages in the southern part of Celebes. New plan:—Bulekomba and Bintaru roads. 2*s*.
651 m	4·0	Japan:—Bungo channel. Plan added:—Amaji ko. 3*s*.
1176 m	0·6	Islands in the South Pacific. New plan:—Niue or Savage island. 2*s*.

Charts Cancelled.

No.	Cancelled by	No.
1296 Plans on the coast of Chile. Plans of Port Low, Inner Port, and Port Melinka on this sheet.	New chart. Guaitecas islands	 3589
2082 Africa, south coast. Table bay to Cape Agulhas. Plans of Table bay and Simon's bay on this sheet.	—	—

Charts that have received Important Corrections.

No. 1188, The World:—Coal and Telegraph chart. 3421, Scotland, west coast:—Broadford bay. 117, Færoe islands. 2300, Baltic sea:—Gulf of Bothnia (Sheet 5). 2526, South America, east coast:—Buenos Aires. 1897*b*, British Columbia:—Victoria harbour. 1844, Borneo:—Labuan island. 1957, China, east coast:—Namoa island. 2653, China, north coast:—Pei ho or Peking river (Sheet 1). 3388, China, north coast:—Terminal head to Hai Yung tau. 2415, Japan:—Approach to Nagasaki harbour. 1079, Tasmania. 1423, New Zealand:—Port Nicholson. 3033, New Hebrides:—New Hebrides islands and New Caledonia.

(*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Meteorological Chart of the Indian Ocean north of 15° S. lat., and Red Sea for November, 1906. London: Meteorological Office, 1906. *Price* 6*d*. *Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Meteorological Chart of the North Atlantic and Mediterranean for November, 1906. London: Meteorological Office, 1906. *Price* 6*d*. *Presented by the Meteorological Office.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for October and November, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Charts of the North Pacific Ocean for November, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

China. Barnardiston.

One hundred and sixty-five photographs of China, taken by Captain E. Barnardiston, R.E., in 1904. *Presented by Captain E. Barnardiston, R.E.*

Captain E. Barnardiston accompanied, as geographical surveyor, Colonel Manifold's expedition through Western China and the Yang-tse valley, an account of which was given in the *Geographical Journal* for June, 1905. These photographs, taken during his travels, form an interesting and instructive series. With the exception of five, which are enlargements, they are all quarter-plate size.

(1) Han river at junction of Shao-Chiang-Ho; (2) Han river, looking down; (3) Han river, looking up; (4) Han river, near Chin-Shan-Liang; (5) Han river, country on left bank towards Yüen-Shan; (6) Han river, near Jiun Jho; (7 and 8) Han river, our boats 10 miles above Jiun-Jho; (9–11) Han river, gorge 7 miles above Yün-Yang Fu; (12–15) Han river, Pai-Ho Hsien; (16) Han river, Yüeh-Erh-Tan; (17 and 18) Han river, Ni-Kho; (19) Han river from Lang-Shui-Ho; (20 and 21) Han river, from above Lang-Shui-Ho; (22) Han river at Siao-Ho-Kho; (23) Han river at Su-Ho-Kho; (24) Typical scenery, Han river; (25) Han river, Hsing-An Fu; (26) View from Mao-Kia-Shan to south of Lo-Ho; (27) Gorge on road to Lo-Ho; (28) Looking down valley near T'sing-Shui-Ho; (29) View down T'sing Ho; (30) View down Lan Ho; (31–34) Near U-To-Ho; (35) Two miles below U-To-Ho; (36) A gorge; (37) In valley of Ta Ho; (38) In valley of Ta Ho at Siu-K'iu-Ba; (39) My escort from Cheng-Kou-Ting; (40) Ta-Chu-Ho; (41) Two miles from Ta-Chu-Ho, on Tai-Ping Hsien road; (42) Near Tai-Ping Hsien; (43) On border of Shên-si and Ssū-Chuan, looking towards Tai-Ping Hsien; (44) On border of Shên-si and Ssū-Chuan, showing Kuan-Lun-Po pass; (45) View from Kuan-Lun-Po, looking south-south-east; (46) Crushed rock in river near Tai-Ping Hsien; (47) Near Tai-Ping Hsien; (48) Tai-Ping river; (49) Coolie carrying cloth near Tai-Ping Hsien; (50) Lo-Yang-Ba; (51) Bridge over Tin-Sa Ho; (52, 53, and 161) Tung-Siang Hsien; (54) Lao-Cheng Ho; (55) Boat-building on river above Sui-Ting Fu; (55) Dr. Wilson's hospital, Sui-Ting Fu; (57) Dr. Wilson's science lecture-hall, Sui-Ting Fu; (58) Rev. A. Palhill and his house, Sui-Ting Fu; (59) Sui-Ting Fu; (60) Eight miles from Sui-Ting Fu; (61) T'ung trees in bloom; (62) View on road to Liang-Shan Hsien; (63) Bridge over Liao Ho, between Liang-Shan and Wan Hsien; (64) On Wan Hsien road; (65) A common type of Ssū-Chuan bridge; (66) Junk on Yang-tzū above Kuei Fu; (67) Yang-tzū, looking down-stream, above Kuei Fu; (68) Yang-tzū, looking up-stream, above Kuei Fu; (69 and 70) Yang-tzū, entrances to gorges below Kuei-Chou Fu; (71) Yang-tzū just above Pei-Shih (72) Yang-tzū, Pei-Shih; (73 and 74) Yang-tzū below Pei-Shih; (75 and 76) Yang-tzū, the Yih-T'an from down-stream; (77, 79, and 162) Yang-tzū, above the Chin-T'an; (78) Yang-tzū, boat coming up the Chin-T'an; (80, 82, and 83) Yang-tzū, looking up-stream from below Chin-T'an; (81) Yang-tzū, looking down-stream from below Chin-T'an; (84 and 85) Yang-tzū Shan-Tao-Ping; (86) Yang-tzū, Lo-Tin-Chi; (87) Chang-Yang in Ching-Chiang Ho valley; (88) In Chang-Yang temple, the ten gods of hell; (89) In Ching-Chiang Ho valley at junction of the Ssū-Yang Ho; (90) Looking up Ssū-Yang Ho from the Ching-Chiang Ho; (91 and 92) Ching-Chiang Ho at Chang-Mu-Lai; (93) Ching-Chiang Ho, near Ya-Tsi-Keo; (94) At Si-Cheo in Ching-Chiang Ho valley; (95) Near U-Sha-Keo in Ching-Chiang Ho valley; (96) A cliff 6000 feet high at Shih-Pan-Chi in Ching-Chiang valley; (97) Kien-Chi Hsien; (98) Covered street, Tien-Chiao; (99) Salt industry at Ju-Shan-Ching, on Lung-Shui Ho; (100) Fou-chou-river; (101) Fou-chou river, gorge below Kong-Keo; (102 and 103) Fou-chou river above Ta-Koa-Pa; (104) "Man-tse-tung," or cave-dwellings, exposed in a stone quarry; (105) A bamboo water-wheel for irrigation about 30 feet high; (106) Irrigation wheels, worked by man inside; (107) A road bridge; (108) Chen-Tu plain from north wall of city; Timber-yard near north gate of Chen-Tu; (110 and 111) Examination hall of Chen-Tu; (112) In temple of Wan-Nien-Ssū, on O-Mei Shan; (113) A laughing Buddha, O-Mei Shan; (114 and 115) O-Mei Shan; (116 and 118) Wayside shrine, O-Mei Shan; (117) A temple, O-Mei Shan; (119) Priests in their room, Chin-Ting, O-Mei Shan; (120, 121, and 124) Chin-Ting temple on summit of O-Mei Shan; (122, 123, 163, and 164) Priests, Chin-Ting temple; (125 and 126) A valley on O-Mei Shan; (127) Entrance of Lung-Sheng-Kang, O-Mei Shan; (128) View on road at base of O-Mei Shan; (129) Coolies carrying coffin wood, O-Mei Shan; (130) On road at base of O-Mei Shan; (131) How pilgrims are carried up, O-Mei Shan; (132) Entrance to a Chinese town in Ssū-Chuan; (133) Ploughing in Ssū-Chuan; (134) An archway at Chang-Chia-Kang; (135) Inn at Lung-An-P'u; (136) Group at Hswang-Liu Hsien; (137) Pig on barrow going to market; (138) Ploughing rice-field in Ssū-Chuan; (139) Group in a village; (140) Two children on roadside; (141) Group at Chiu-Lin; (142) A typical Ssū-Chuan village, Ting-Kwan-Tzū; (143) Coolie with load of wood; (144) Old woman and child on bridge; (145) A Ssū-Chuan valley; (146) A Ssū-Chuan bridge;

(147) A Ssŭ-Chuan town; (148) Group at Yung-Feng-Chang; (149 and 165) Coolie with load of wooden bowls, etc.; (150) Chun Chou, on Yang-tzŭ Chiang; (151) Typical farmhouse, Ssŭ-Chuan; (152) Coolie with my bedding, etc.; (153) Scene on road in Ssŭ-Chuan; (154) A bridge in Ssŭ-Chuan; (155) A Ssŭ-Chuan valley; (156) "Three generations" (two rows of stepping-stones and one bridge); (157) A farmstead in Ssŭ-Chuan; (158) Old woman washing clothes; (159) Inn at San-Chan-Pu; (160) A load of reed-pith on the Yang-tzŭ at Yun-Yang Fu.

Nigeria. **Beak**

Sixty-four photographs of Northern and Southern Nigeria, taken by G. B. Beak, Esq. *Presented by G. B. Beak, Esq.*

A series of small photographs chiefly interesting as illustrative of the manner of life, industries, and customs of the natives. The titles are as follows:—

(1) The Residency, Ilorin; (2–4) The emir of Ilorin and his chiefs; (5) Women dyeing cloth, Ilorin; (6) Leather-workers, Ilorin; (7) Weavers at Ilorin; (8) Looms, Ilorin; (9) Group of political officers, Ilorin; (10) Building grass huts to accommodate small-pox patients, Ilorin; (11) A native smithy, Ilorin; (12) Brass workers, Ilorin; (13) Pot-makers, Ilorin; (14) "Le Coiffeur," Ilorin; (15) Group of Yorubas near Ilorin; (16) A native crowd at Ilorin; (17) A typical crowd of Hausas and Yorubas at Ilorin; (18) The Baloguns of Ilorin; (19) A view on the Niger near Lokoja; (20) The tennis courts, Lokoja; (21) Polo at Lokoja; (22) Yoruba drummers; (23 and 24) A group of Yorubas; (25–27) Fishing on the Benue; (28) A reach of the Benue; (29) A halt on the caravan route between Lagos and Kano; (30) A group of headmen *en route* from Kano to Lagos; (31) The witch of Awtun; (32) The guard; (33) An officer's stores on trek; (34) *En route;* (35 and 36) A group of Munchis; (37) A procession at the Feast of Ramadan; (38) Crossing a stream; (39) An old woman winding thread; (40) Fulani horsemen; (41) The junction of the Niger and the Benue; (42) A Hausa bed; (43) Caravan toll station; (44) Sir Frederick Lugard's S.Y. *Corona;* (45) Native fire signs; (46) Native Indaba; (47) Quarrying stone; (48) A characteristic view from a stern-wheeler on the Niger; (49) The acting High Commissioner; (50) The bridge-builders; (51) Northern Nigerian cattle; (52–55) Road-making; (56) Road-making, the onlookers; (57) A Jukum king and his chief men; (58) A caravan of women; (59) A caravan *en route;* (60) A caravan outspanned; (61) Nupe huts; (62) A characteristic view on the Lower Niger; (63) Native canoes on the Lower Niger; (64) Preparing for an expedition, Southern Nigeria.

Northern Nigeria. **Temple.**

One hundred and forty-five photographs of Northern Nigeria, taken by C. L. Temple, Esq. *Presented by C. L. Temple, Esq.*

A set of half-plate photographs. Not only are they of exceptional merit as specimens, but Mr. Temple has been most careful in the selection of subjects, and has chosen those that are likely to be valuable, specially from a geographical and ethnological point of view. They are arranged in sets according to the subjects. Mr. Temple has held important positions in Northern Nigeria for years past, and is now Resident at Bauchi.

(1) Maifoni fort; (2) Maifoni market; (3–5) Freed slaves' home, Maifoni; (6–8) Troops resting, Maifoni; (9–17) Kanuri horsemen at Maifoni; (18–20) Sir F. Lugard at Maifoni; (21–30) Maifoni and Monganui markets; (31–34) The residency, Maigomeri; (35–36) Bornu prisoners; (37 and 38) Bauchi prisoners; (39–43) The emir of Gombe and native escort; (44 and 45) Poisonous plant; (46) Fulani dancers; (47) A Nigerian horse; (48) Wase rock; (49–53) Pagan Bolewa at Guduku on the river Gongola; (54–56) Views on river Gongola; (57) River Gongola near Gombe; (58) View of Gombe; (59) Ruined Kano gate, Kukawa; (60–63) Views in and about Kukawa; (64 and 65) Muster of carriers; (66) Rest house, Napada; (67 and 68) Animal transport, Bornu; (69) Camp in Bornu; (70–75) Kanuri wrestlers, Gujba; (76–83) Fulani herds; (84 and 85) Fishing nets; (86–92) Views on the river Benue between Ibi and Lokoja; (93–101) Views in and about Bauchi; (102–110) Emir of Bauchi's messengers; (111–121) Views in and about Napada, on river Gongola; (122–133) Kanuri dancers, Gujba; (134–145) Presentation of a state umbrella and saddle to the sultan of Bornu, by Sir F. Lugard, December, 1904.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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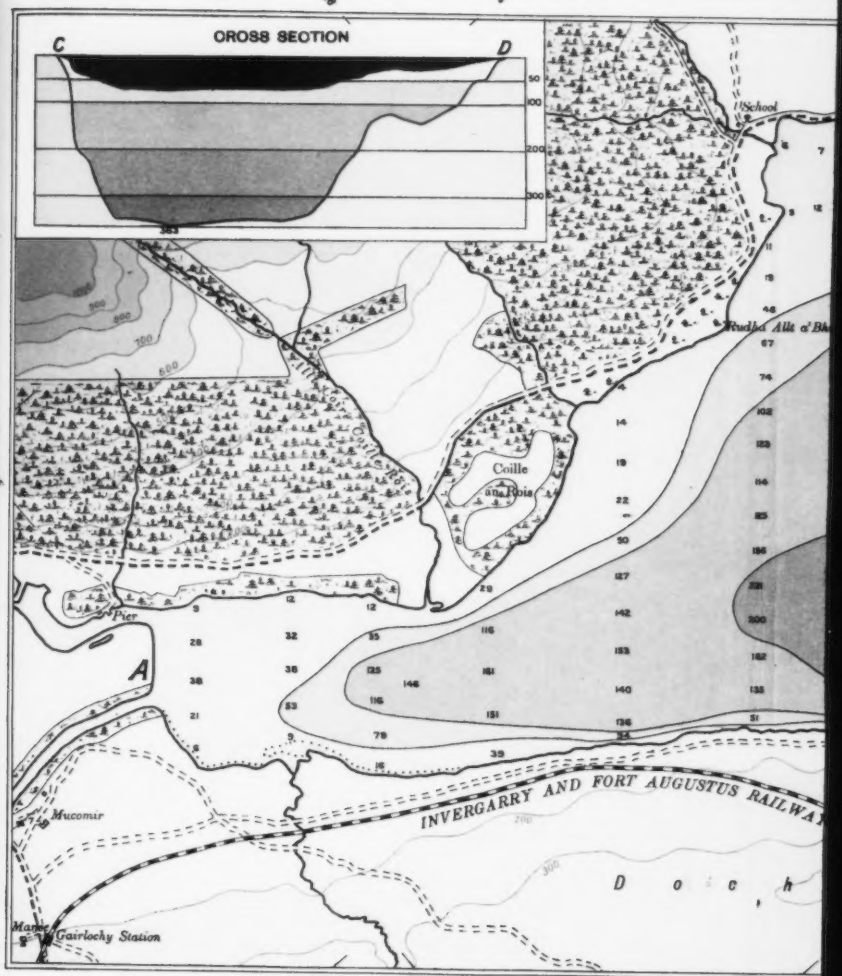
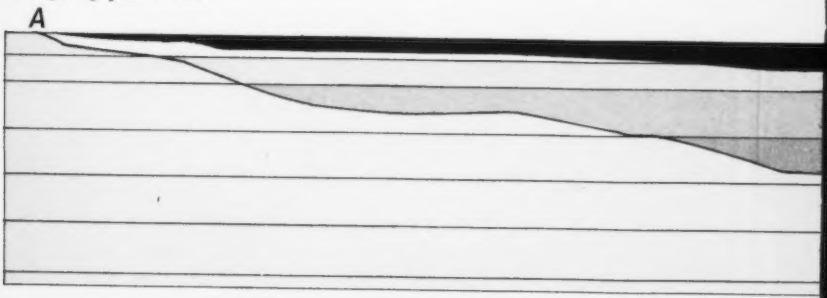
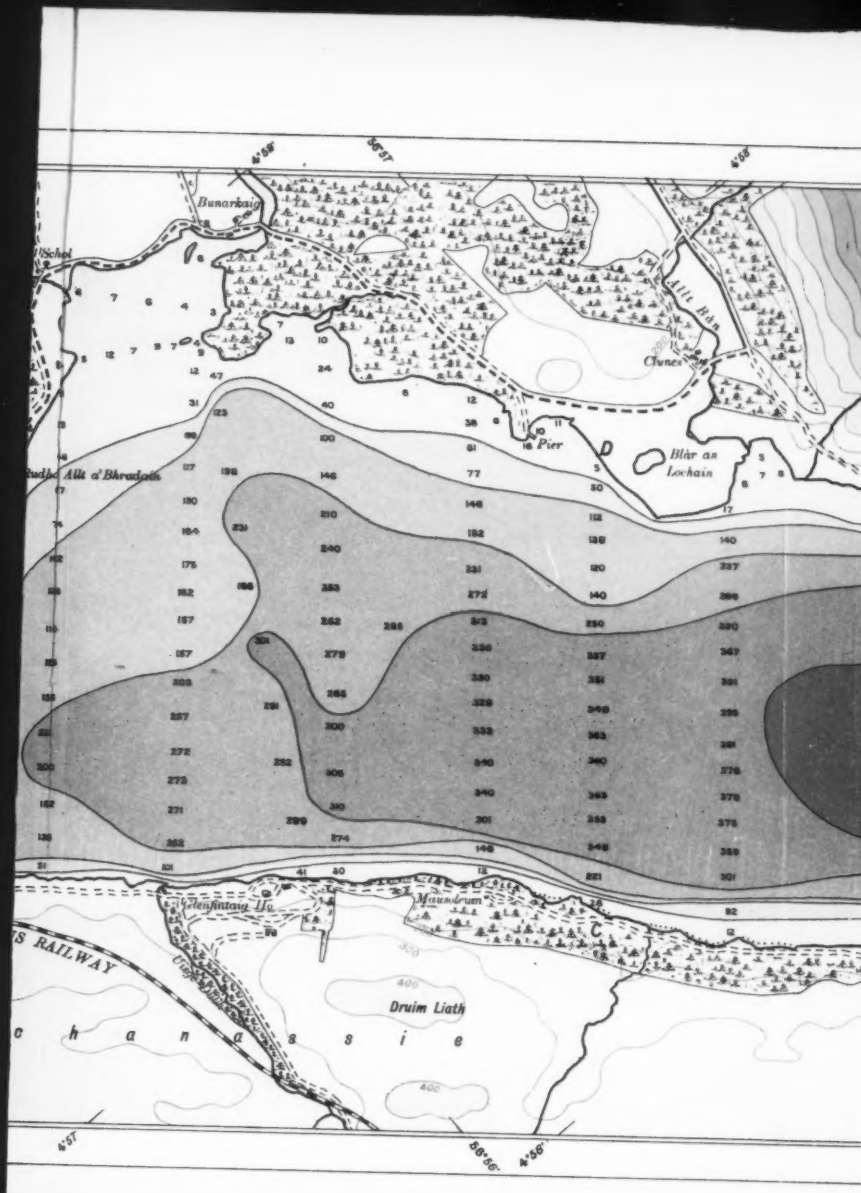
PLATE I



The Edinburgh Geographical Institute

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Clunes
Pier
Blàr an Lochain
Allt a'Bhraclaich
Glenfintaig Ho
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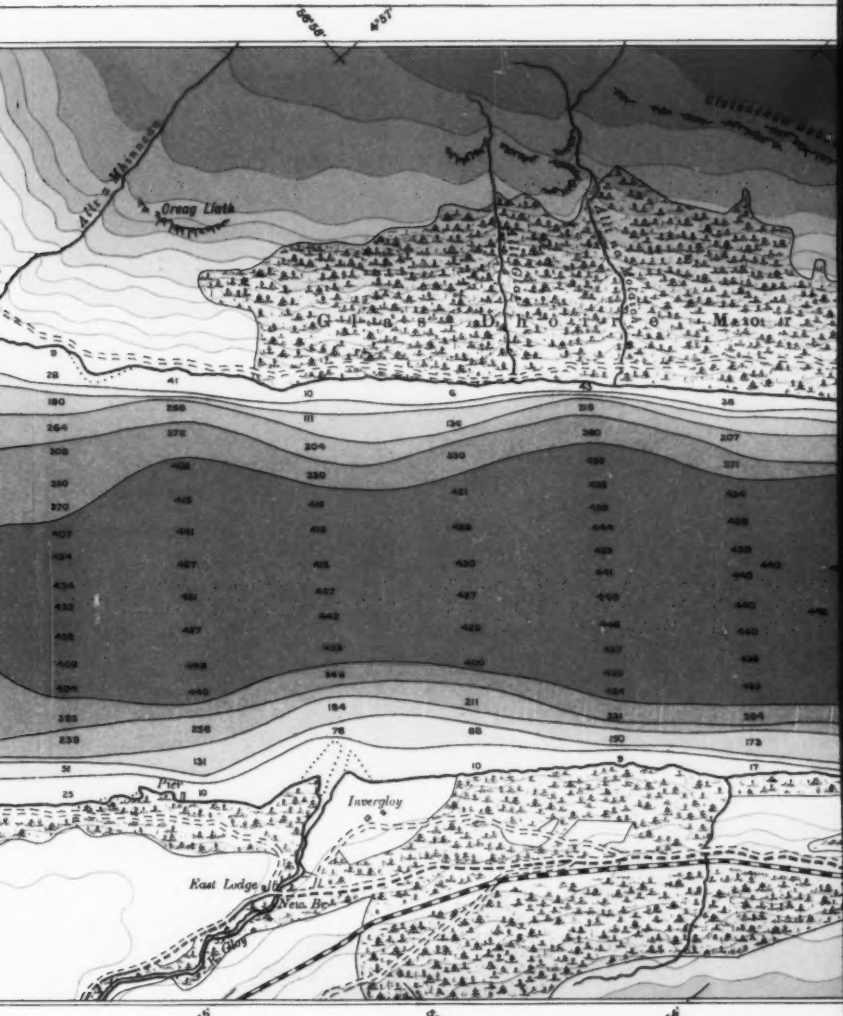
c h a n a s s i e

BATHYMETRICAL SURVEY

SIR JOHN MURRAY.

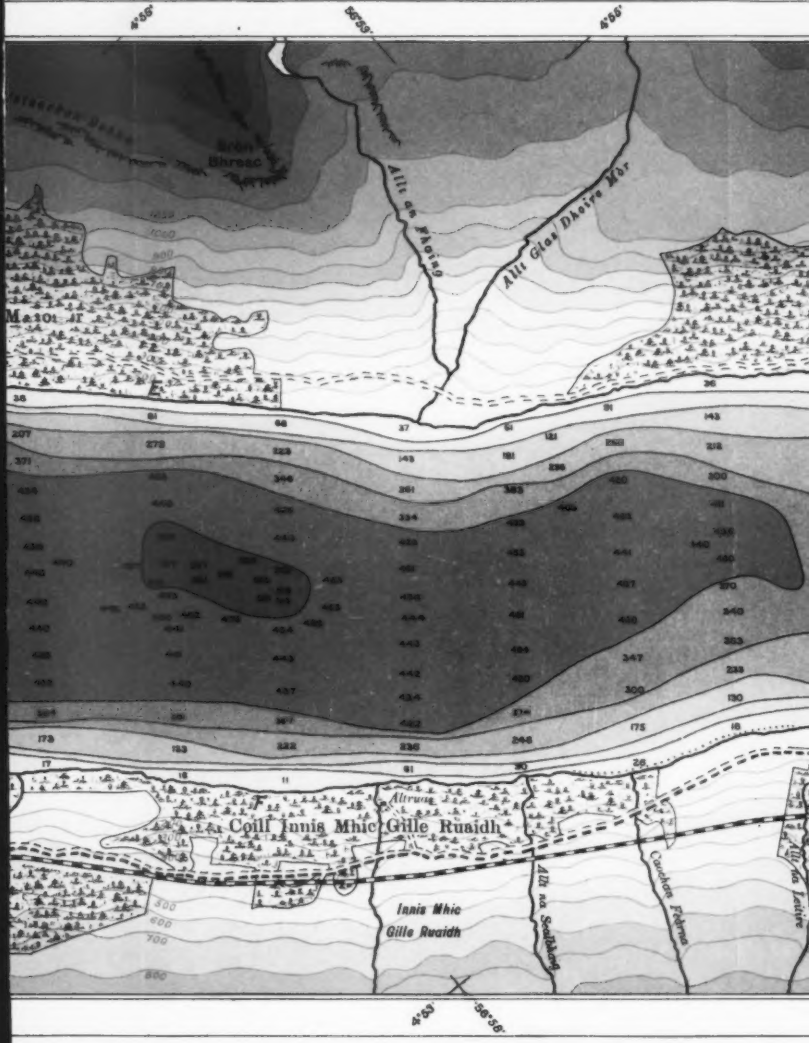


LONGITUDINA

URVEY OF THE FRESH-WATER LOCHS OF S

UNDER THE DIRECTION OF

MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



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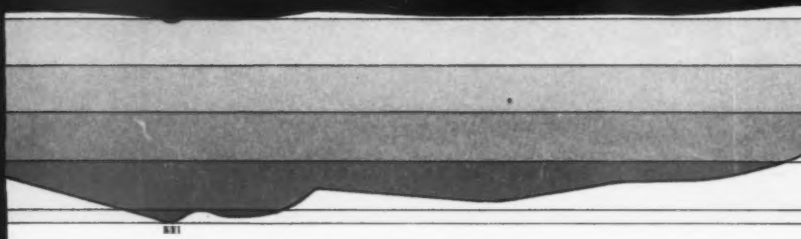

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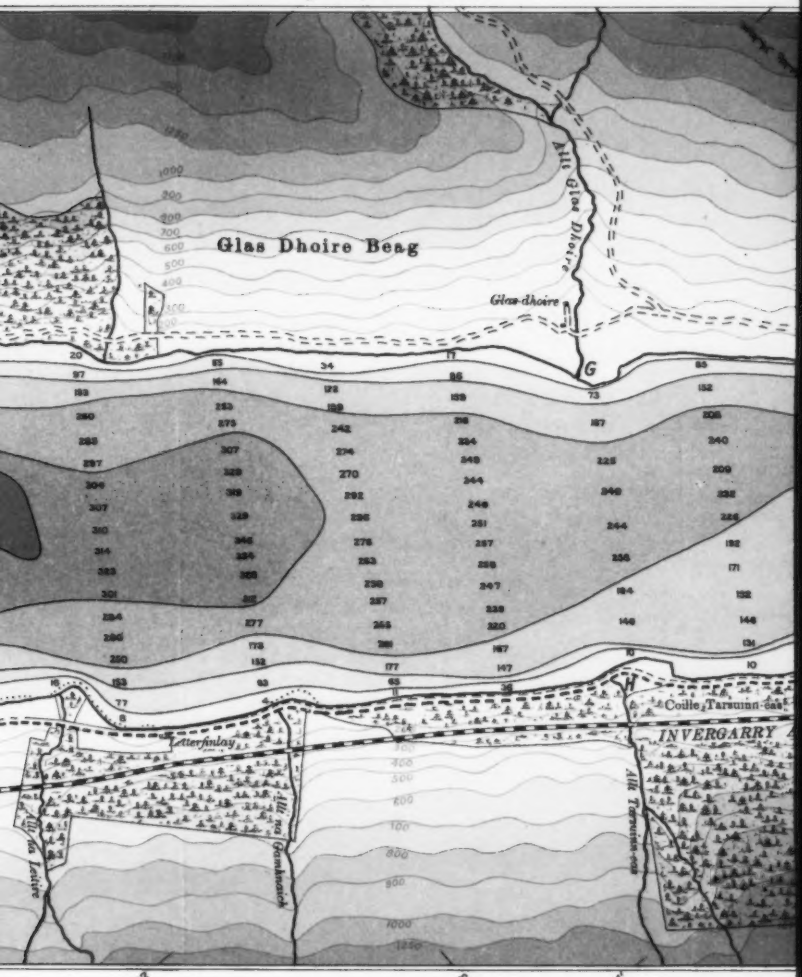
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Allt Tarsuinn-eas

Kilfinnan Wood
General Wades Military Road
FORT AUGUSTUS RAILWAY
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NOTE TO SECTIONS
Scale of Length 3 inches = 1 Mile same as in Map
The Black Part is the Section on the same Scale ; the Blue Colour shows the Section with Depths exaggerated 5 times

LOCH LOCHY

(LOCHY BASIN)

SURVEYED IN 1903 BY

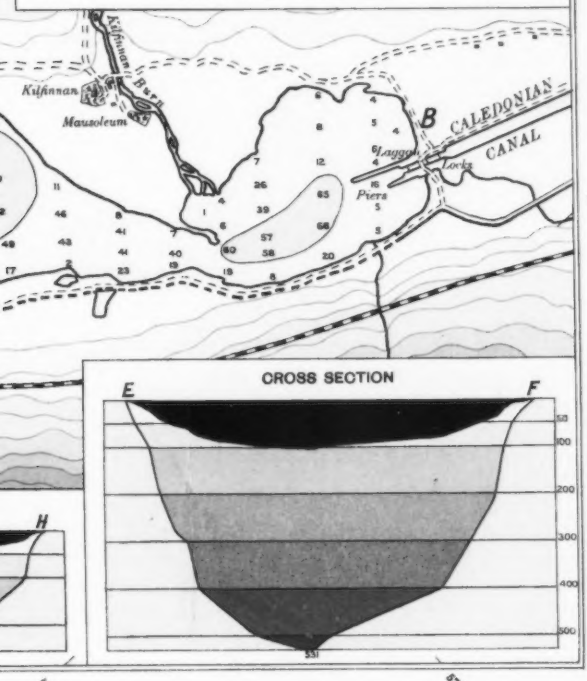
SIR JOHN MURRAY, DR T. N. JOHNSTON,
R. B. YOUNG, B.Sc., R. C. MARSHALL, M.A.,
AND E. M. WEDDERBURN, M.A.

Height of Surface of Water above Sea Level, 94·24 feet

The Land Contours are from the Ordnance Survey

Scale 1: 21,120 3 INCHES TO 1 MILE

0·21 KILOMETRE — 1 CENTIMETRE



HEIGHTS IN FEET

FEET	METRES
2250	685·8
2000	609·6
1750	533·4
1500	457·2
1250	381·1
1000	304·8
900	274·3
800	243·8
700	213·4
600	182·9
500	152·4
400	121·9
300	91·4
200	61

DEPTHS IN FEET

FEET	METRES
50	15·2
100	30·5
200	61
300	91·4
400	121·9
500	152·4

CROSS SECTION

J. G. Bartholomew.

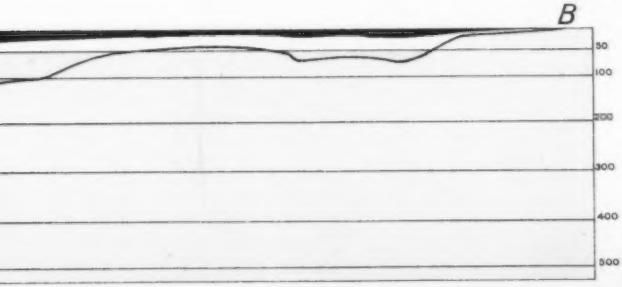
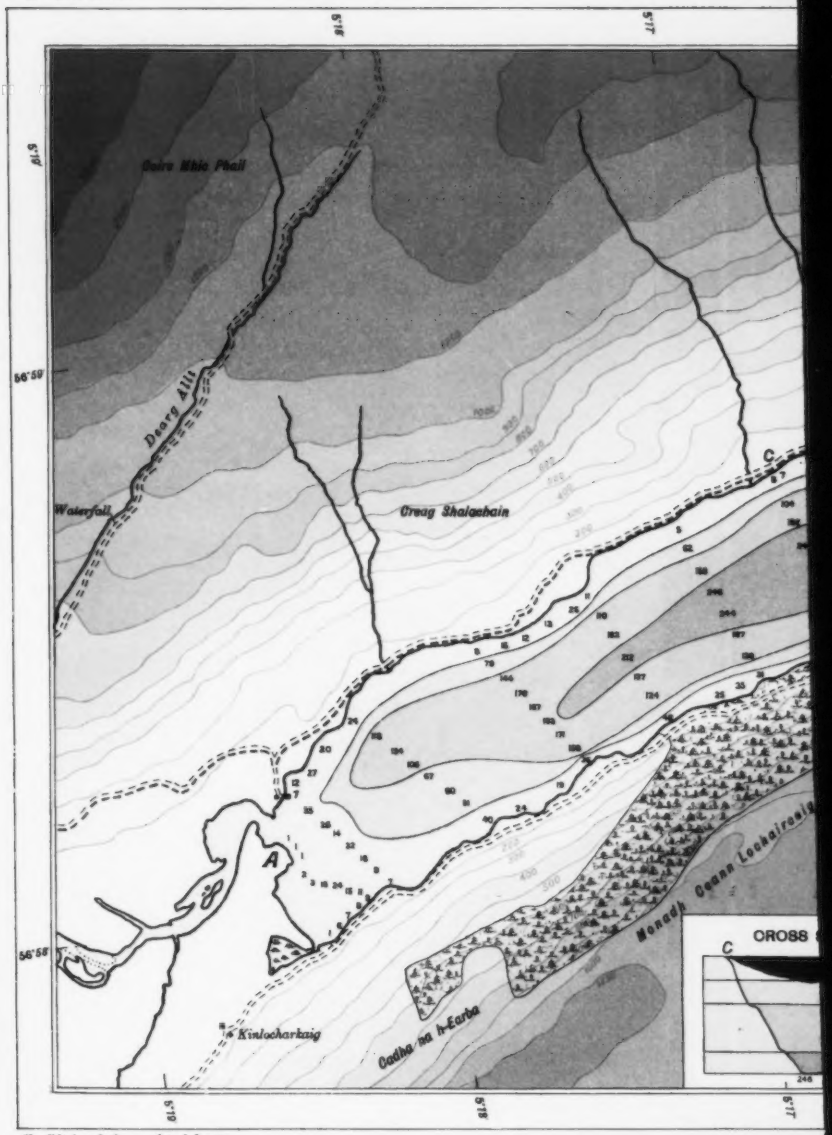
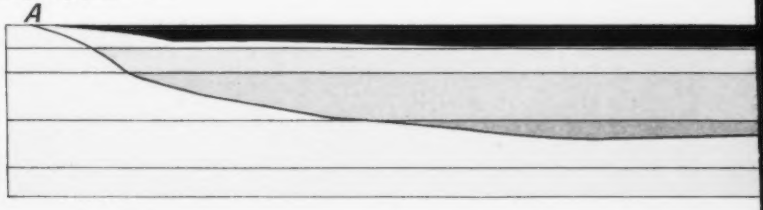
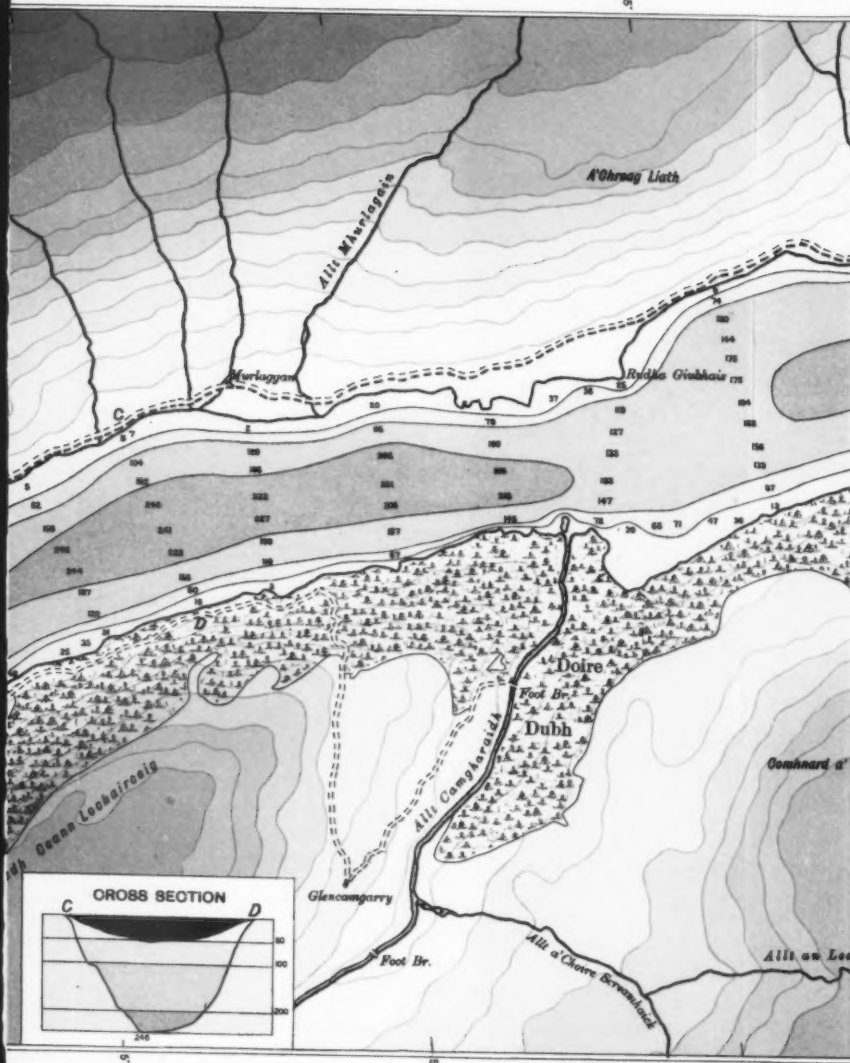


PLATE II



The Edinburgh Geographical Institute

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BATHYMETRICAL SURVEY OF T

UNI

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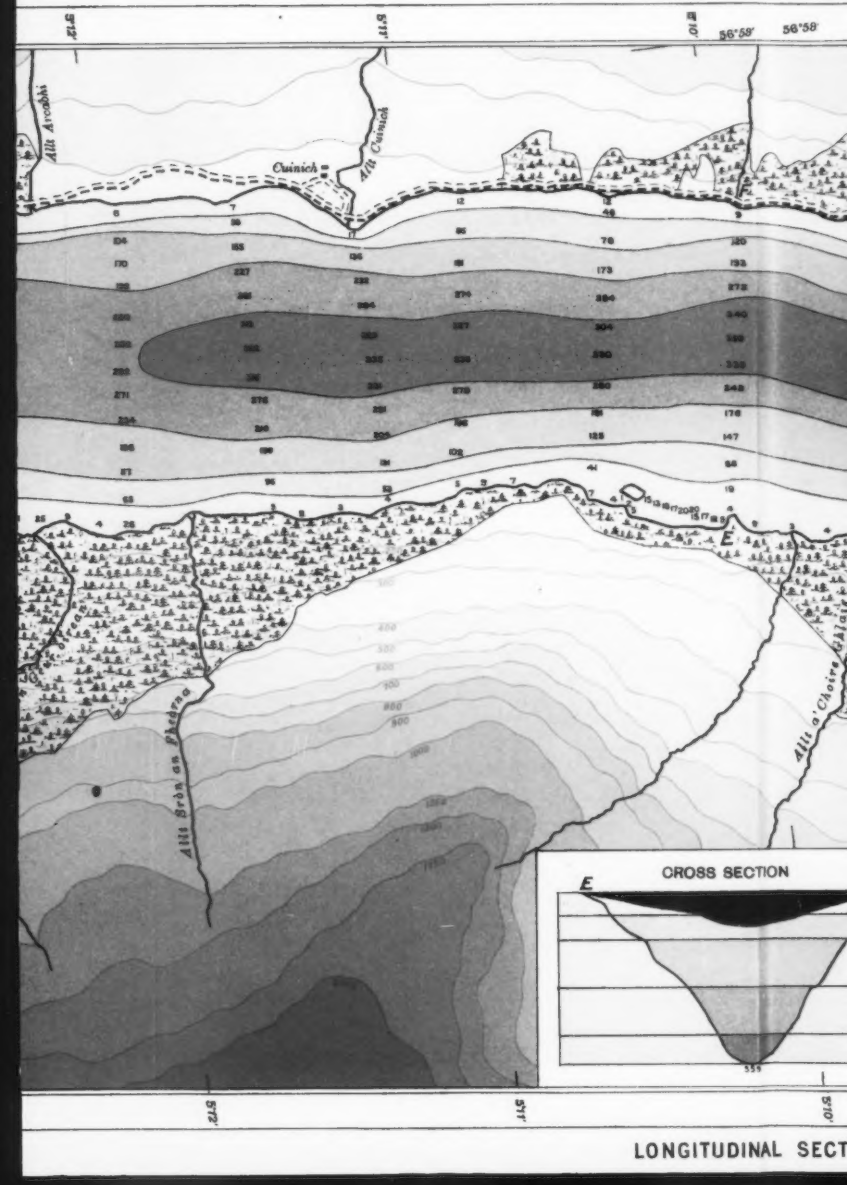
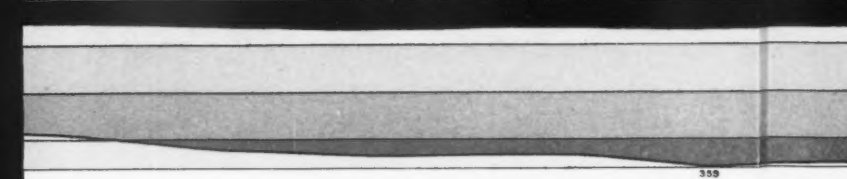


LONGITUDINAL SECT



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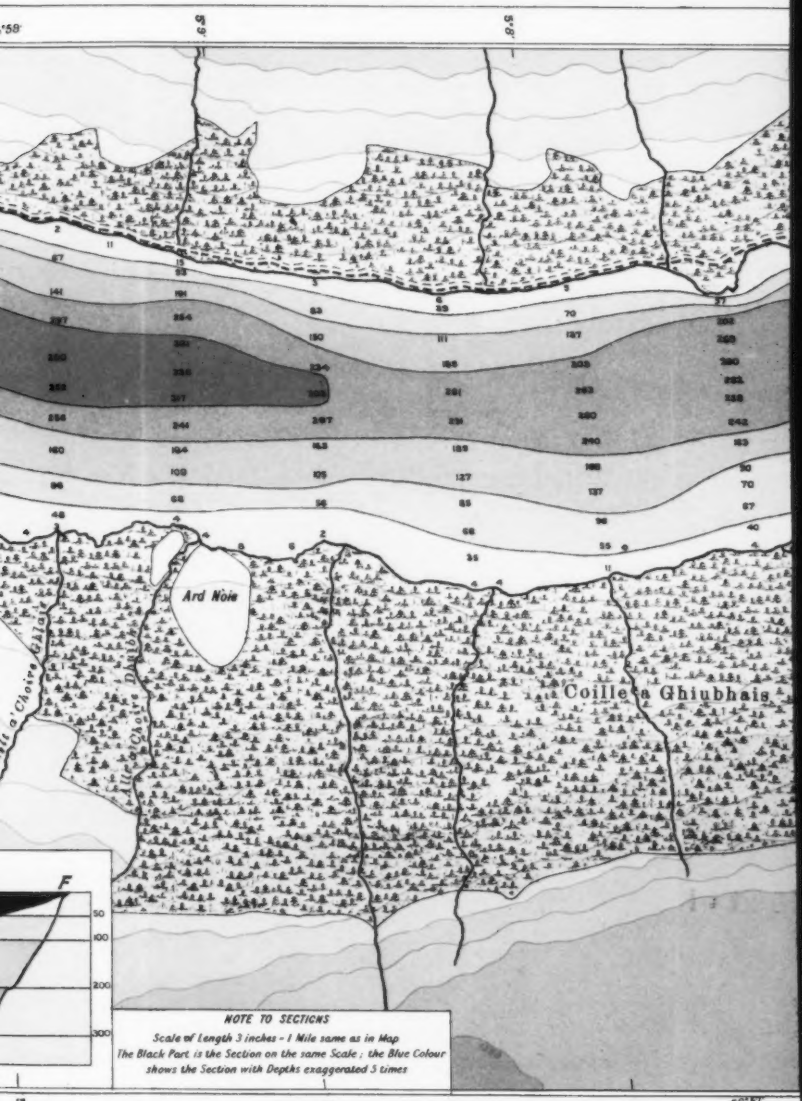
F THE FRESH-WATER LOCHS OF SCOTLAN

UNDER THE DIRECTION OF

B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.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NOTE TO SECTIONS
Scale of Length 3 inches = 1 Mile same as in Map
The Black Part is the Section on the same Scale; the Blue Colour shows the Section with Depths exaggerated 5 times

SECTION ALONG AXIS OF MAXIMUM DEPTH

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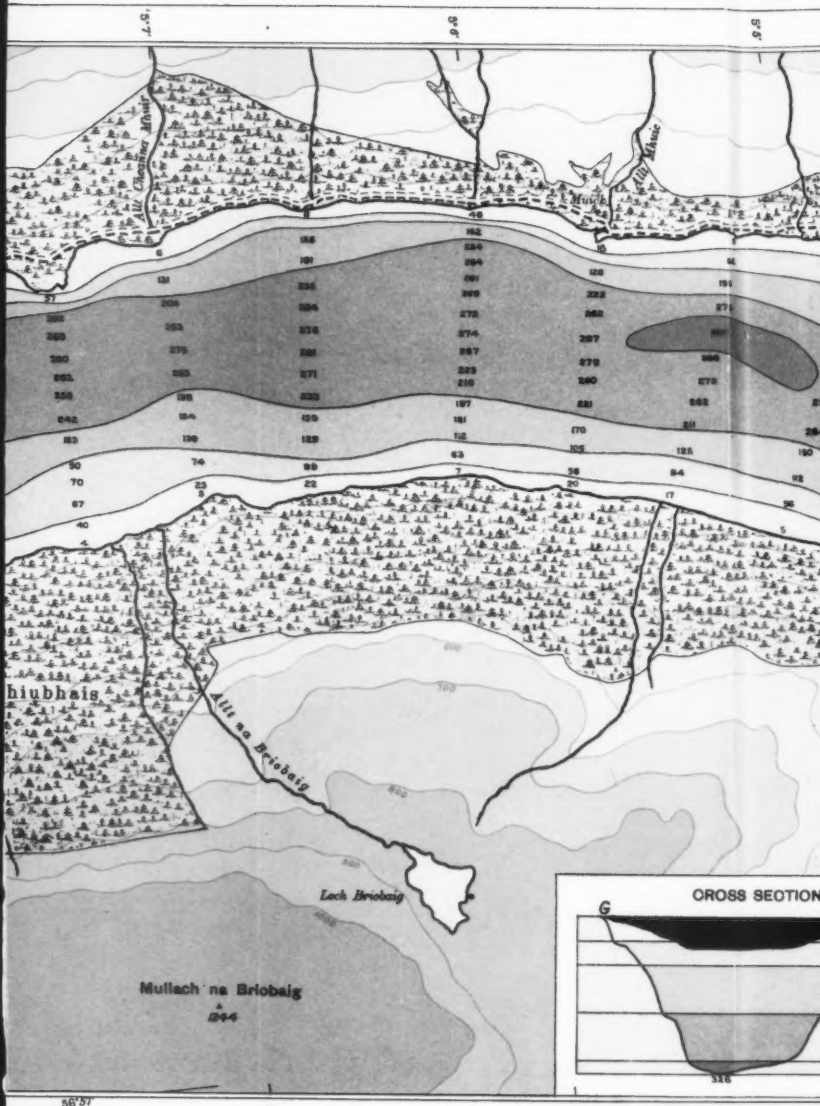
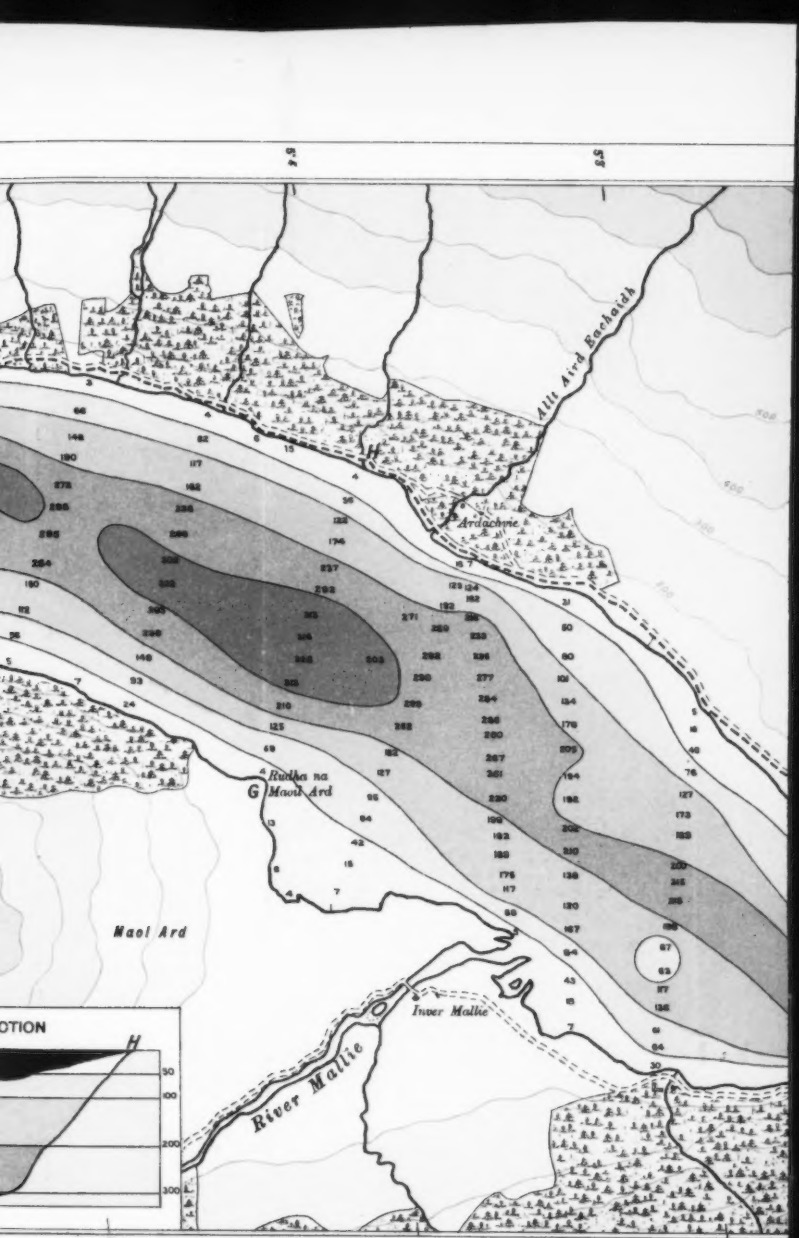
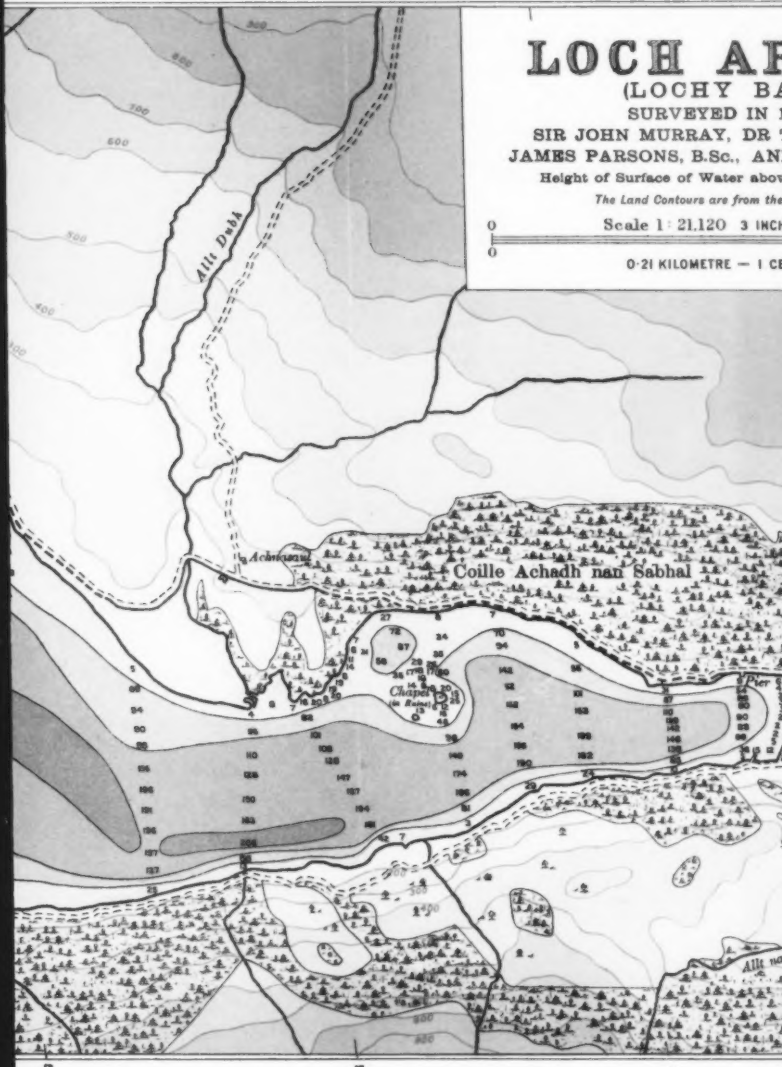
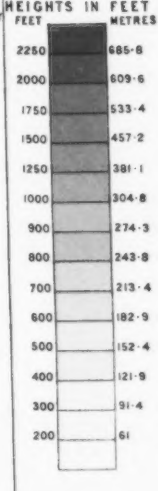
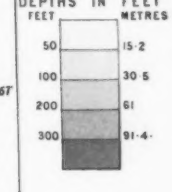

Allt Chaorr Mhor
Allt Mheuc
Allt na Bricbaig
Loch Bricbaig
Mullach na Bricbaig
CROSS SECTION
G


Allt Aird Eachaidh
Ardachrie
Rudha na Maoil Ard
Maol Ard
Inver Mallie
River Mallie
OTION
H
50
100
200
300


LOCH AR
(LOCHY BA
SURVEYED IN
SIR JOHN MURRAY, DR
JAMES PARSONS, B.Sc., AN
Height of Surface of Water abov
The Land Contours are from the
Scale 1: 21,120 3 INCH
0·21 KILOMETRE — 1 CE
Allt Dubh
Achnacarry
Coille Achadh nan Sabhal
Chapel
Pier
Allt

ARKAIG
BASIN)
IN 1902 BY
DR T. N. JOHNSTON,
AND JAMES MURRAY
r above Sea Level, 139 feet
From the Ordnance Survey
3 INCHES TO 1 MILE
Mile
Kilometres 1·61
— 1 CENTIMETRE
56°58'
56°57'
Foot Br.
Achnacarry Ho
Achnacarry House
Post Office
Allt na h Eirdh
J. G. Bartholomew.


HEIGHTS IN FEET
FEET
METRES
2250 685·8
2000 609·6
1750 533·4
1500 457·2
1250 381·1
1000 304·8
900 274·3
800 243·8
700 213·4
600 182·9
500 152·4
400 121·9
300 91·4
200 61


DEPTHS IN FEET
FEET
METRES
50 15·2
100 30·5
200 61
300 91·4

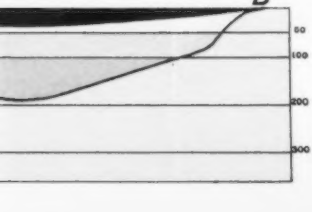
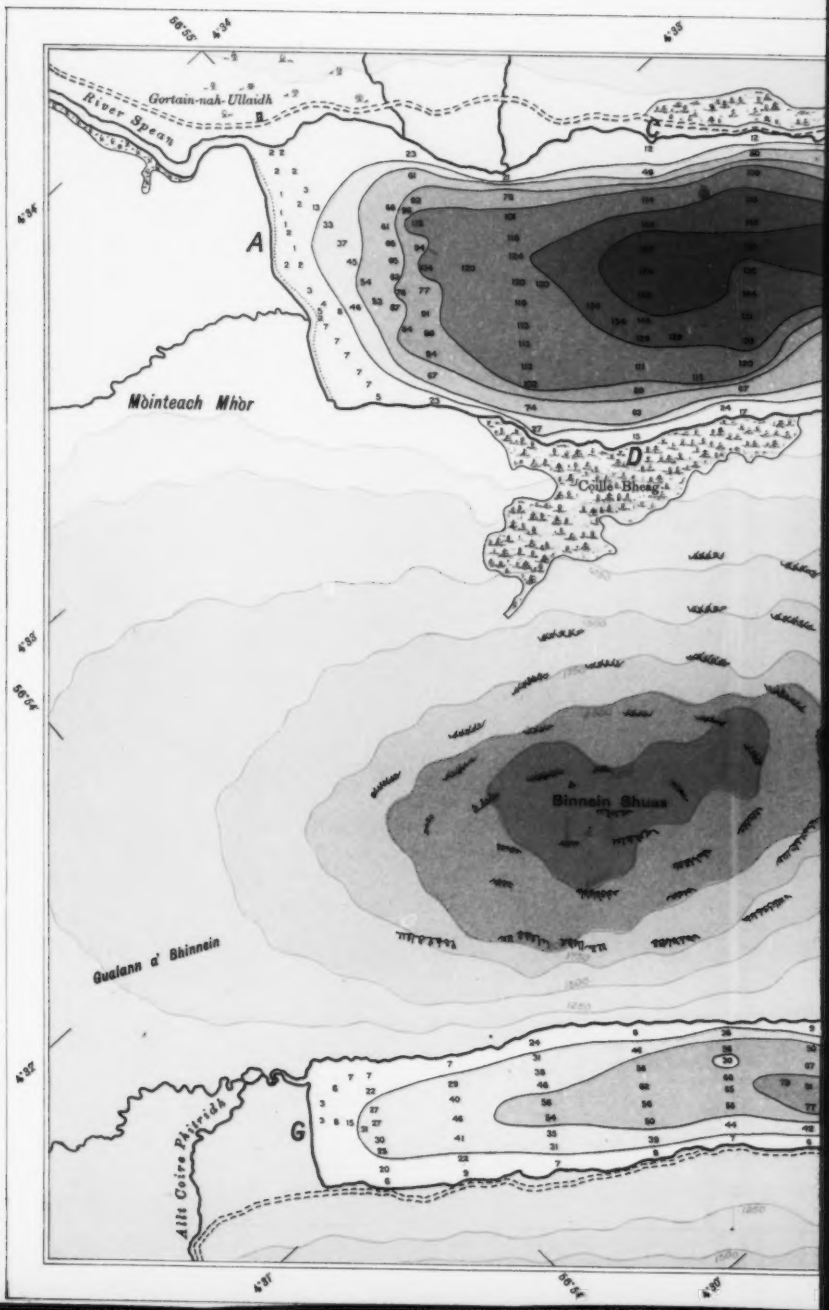

B
50
100
200
300

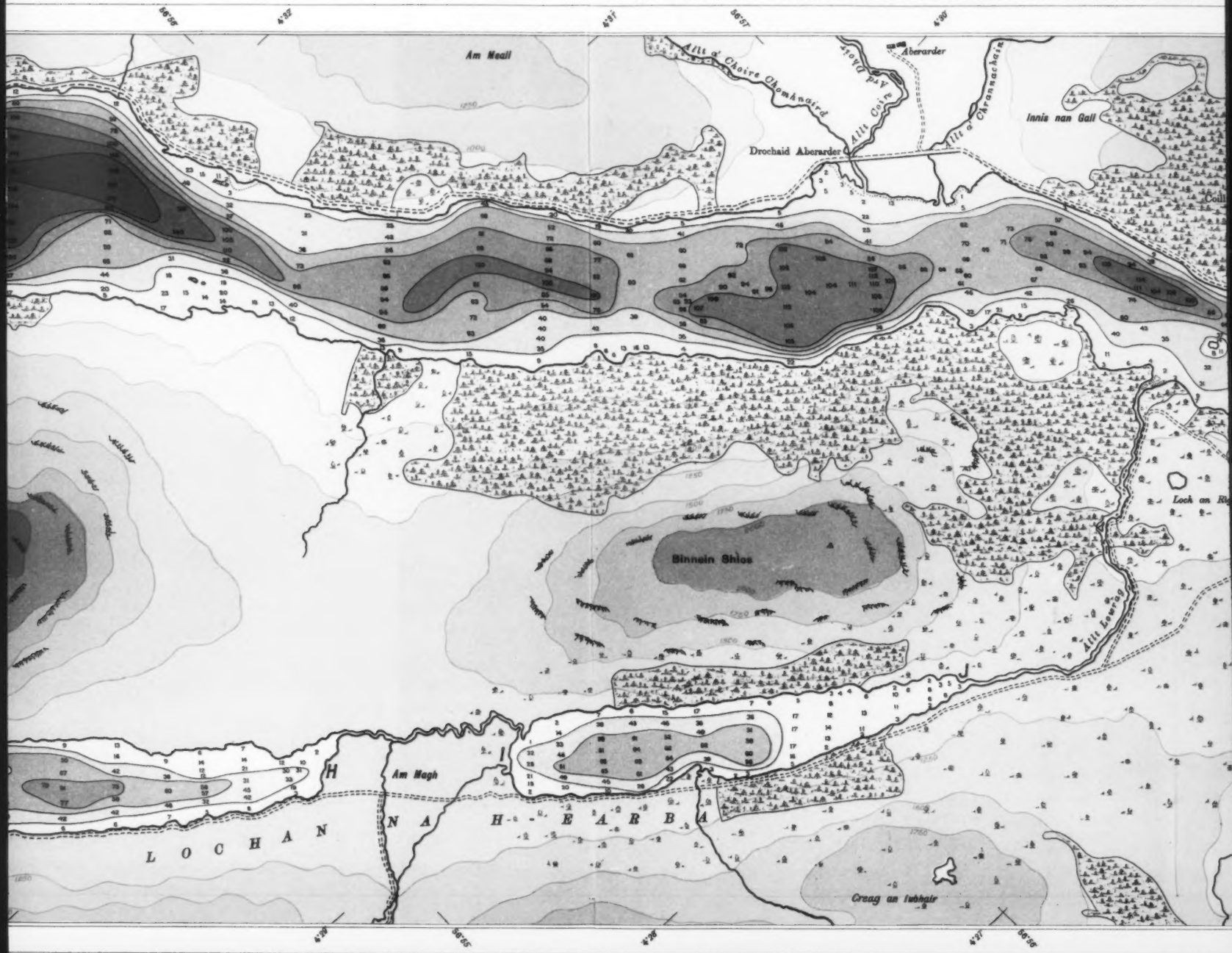
PLATE III

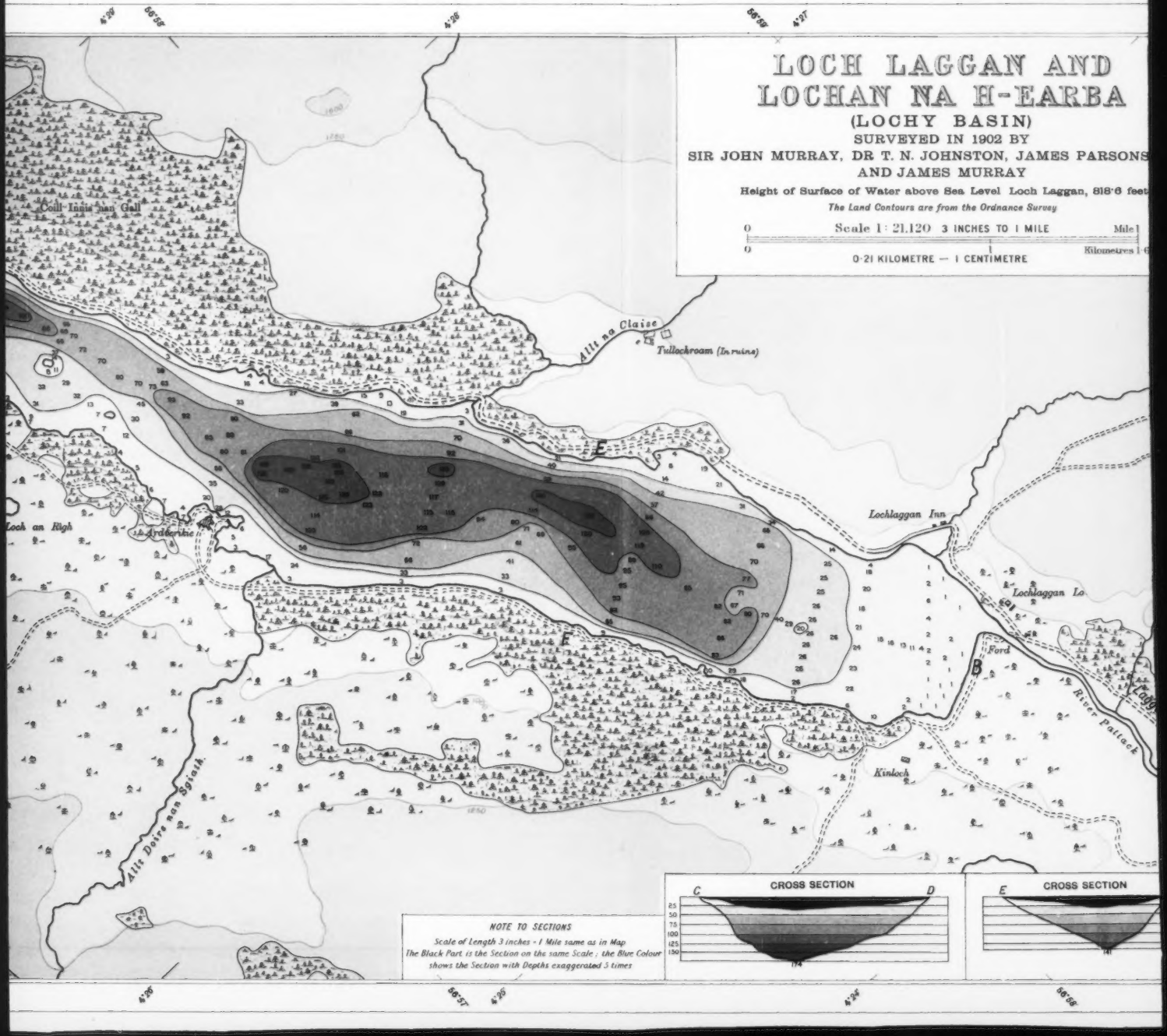

Gortain-nah-Ullaidh
River Spean
A
Mòinteach Mhòr
D
Coille Bheag
Binnein Shuas
Gualann a' Bhinnein
G
Allt Coire Fhiridh

Bathymetrical Survey of the Fresh-water Lochs of

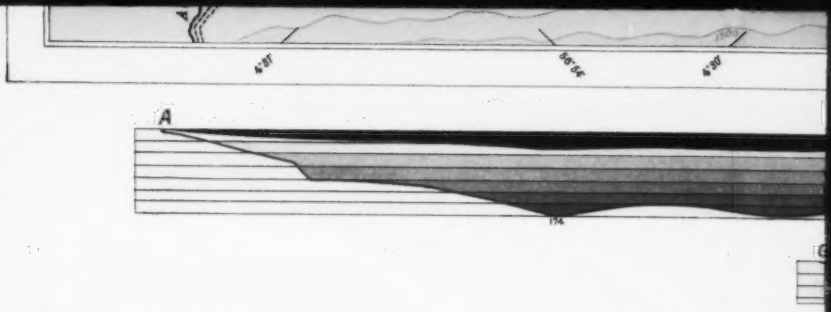
UNDER THE DIRECTION OF

Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., and LAURENCE PULLAR, F.R.S.E.




4°29'
56°56'
4°28'
56°56'
4°27'
LOCH LAGGAN AND
LOCHAN NA H-EARBA
(LOCHY BASIN)
SURVEYED IN 1902 BY
SIR JOHN MURRAY, DR T. N. JOHNSTON, JAMES PARSONS
AND JAMES MURRAY
Height of Surface of Water above Sea Level Loch Laggan, 818·6 feet
The Land Contours are from the Ordnance Survey
Scale 1 : 21,120 3 INCHES TO 1 MILE
Miles
0·21 KILOMETRE — 1 CENTIMETRE
Kilometres
Coill Inuis nan Gall
Allt na Claise
Tullochroam (In ruins)
Loch an Righ
Ardverikie
Lochlaggan Inn
Lochlaggan Lo
Ford
River Pattack
Kinloch
Allt Doire nan Sgiath
NOTE TO SECTIONS
Scale of Length 3 inches = 1 Mile same as in Map
The Black Part is the Section on the same Scale ; the Blue Colour shows the Section with Depths exaggerated 5 times
CROSS SECTION
C
D
25
50
75
100
125
150
114
CROSS SECTION
E
4°26'
56°57'
4°25'
4°24'
56°56'

D
BA
ARSONS, B.Sc.
818·6 feet
Mile
ilometres 1·61
HEIGHTS IN FEET
FEET
METRES
2250
685·8
2000
609·6
1750
533·4
1500
457·2
1250
381·1
1000
304·8
900
274·3
DEPTHS IN FEET
FEET
METRES
25
7·6
50
15·2
75
22·9
100
30·5
125
38·1
150
45·7
Patteck
CTION
F
25
50
75
100
125



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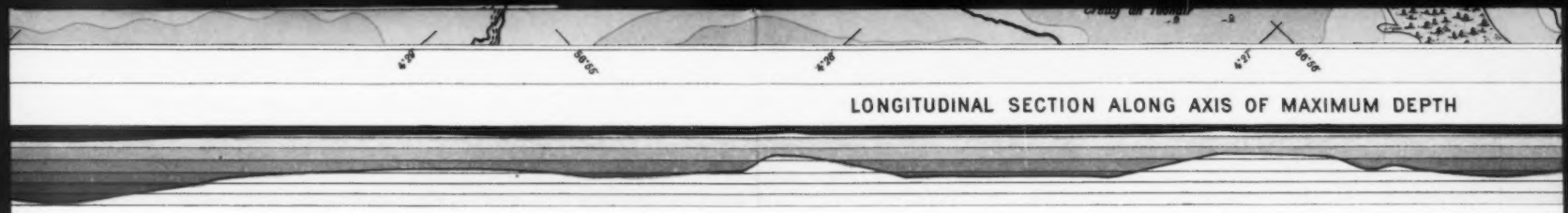

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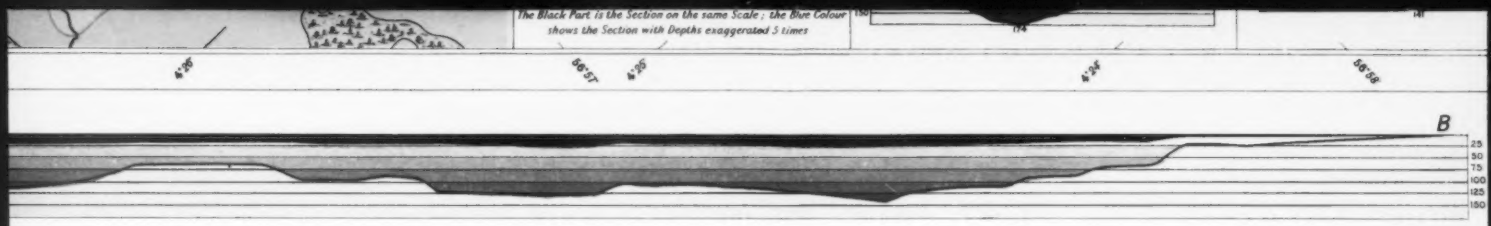
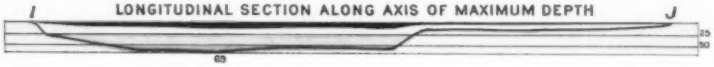

The Black Part is the Section on the same Scale ; the Blue Colour shows the Section with Depths exaggerated 5 times
4°25'
56°57'
4°25'
4°24'
56°58'
B
25
50
75
100
125
150


I
LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH
J
25
50
69

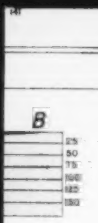


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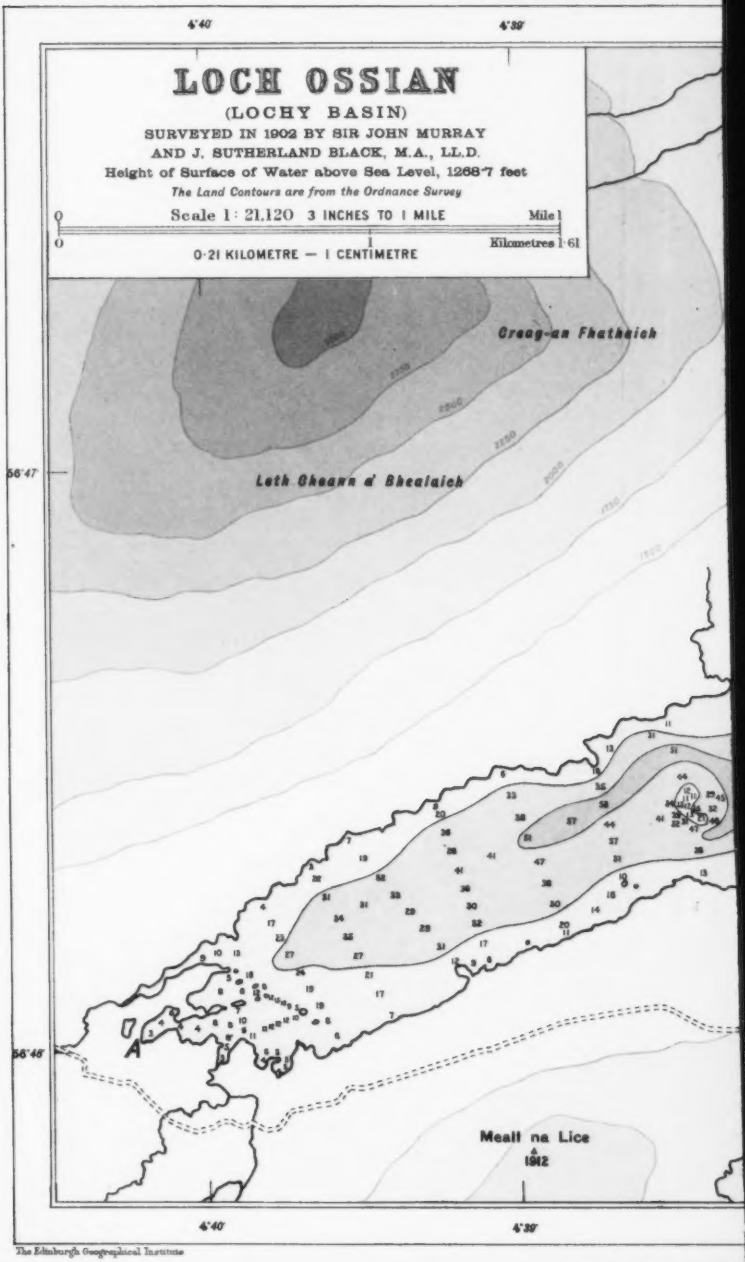
PLATE IV



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A

LONGITUDINAL SECTIO

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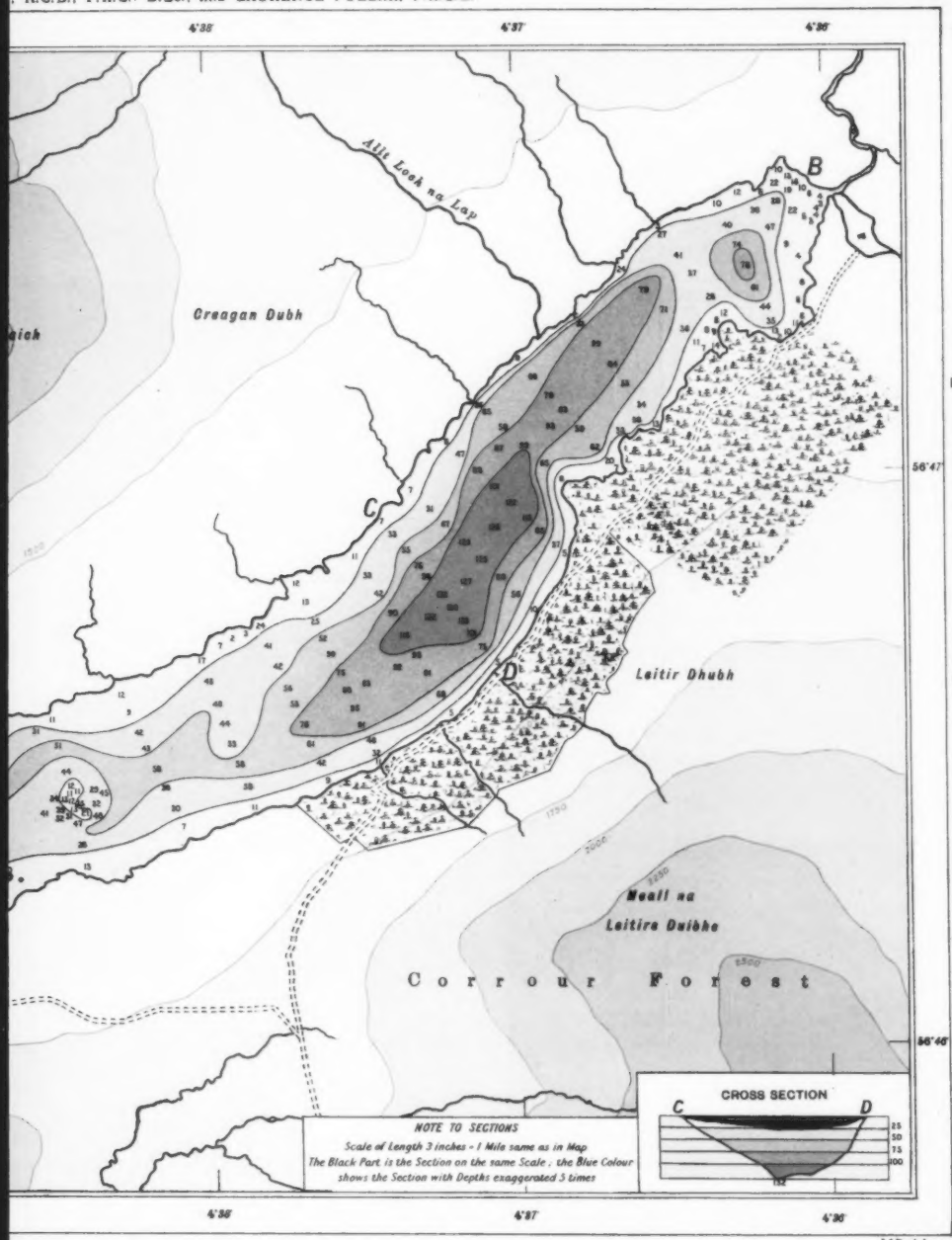

DINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

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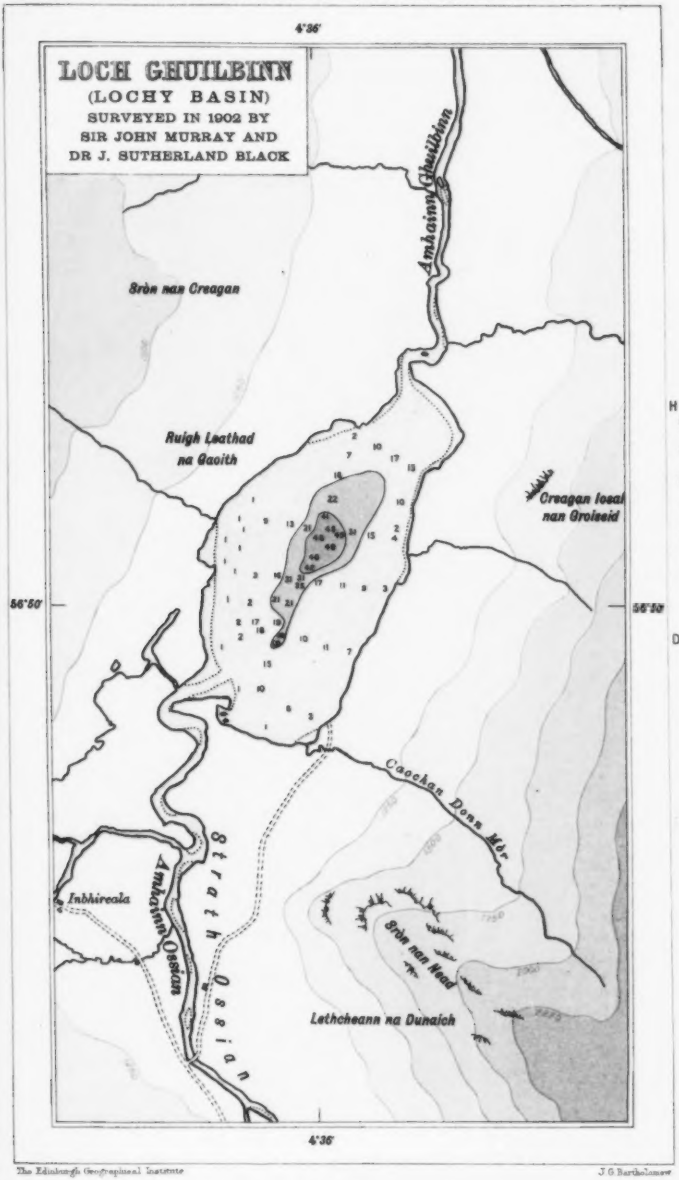

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Scale 1: 21,120 3 INCHES TO 1 MILE Mile 1

Kilometres 1·61

0·21 KILOMETRE — 1 CENTIMETRE

The Land Contours are from the Ordnance Survey

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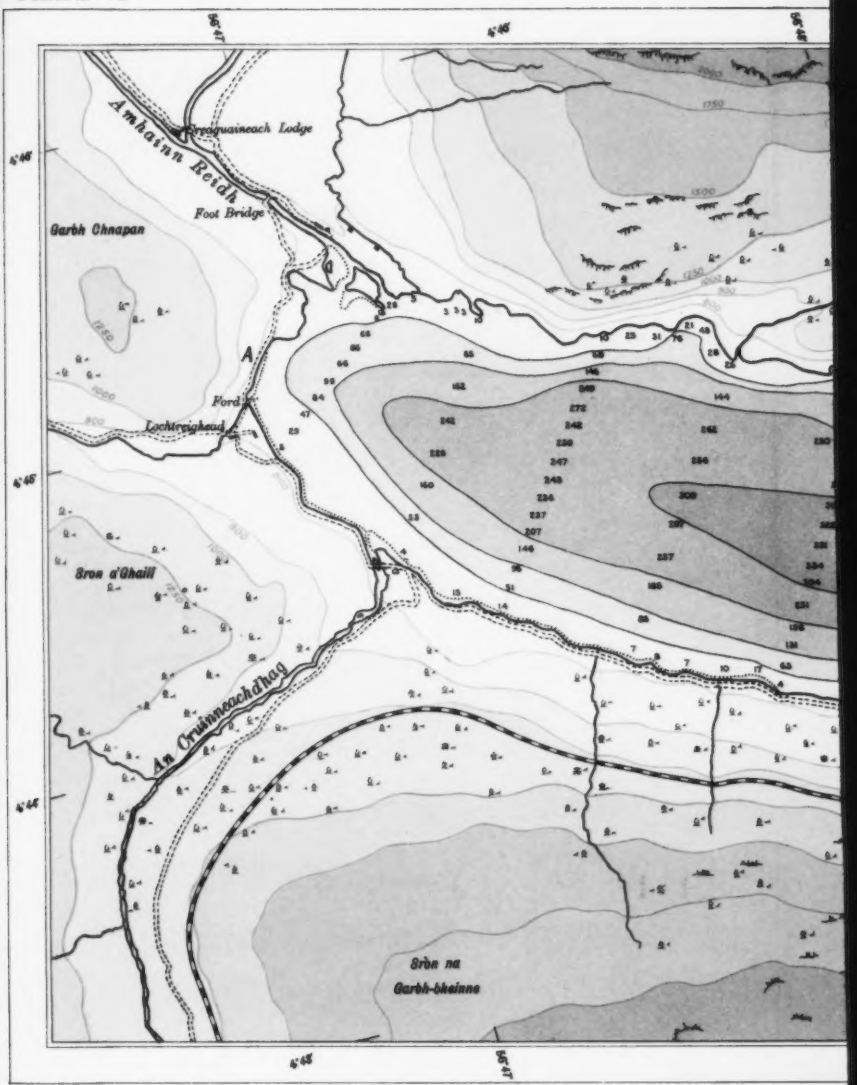
PLATE VI



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Bathymetrical Survey of the Fresh-water Lochs of Scotland

UNDER THE DIRECTION OF

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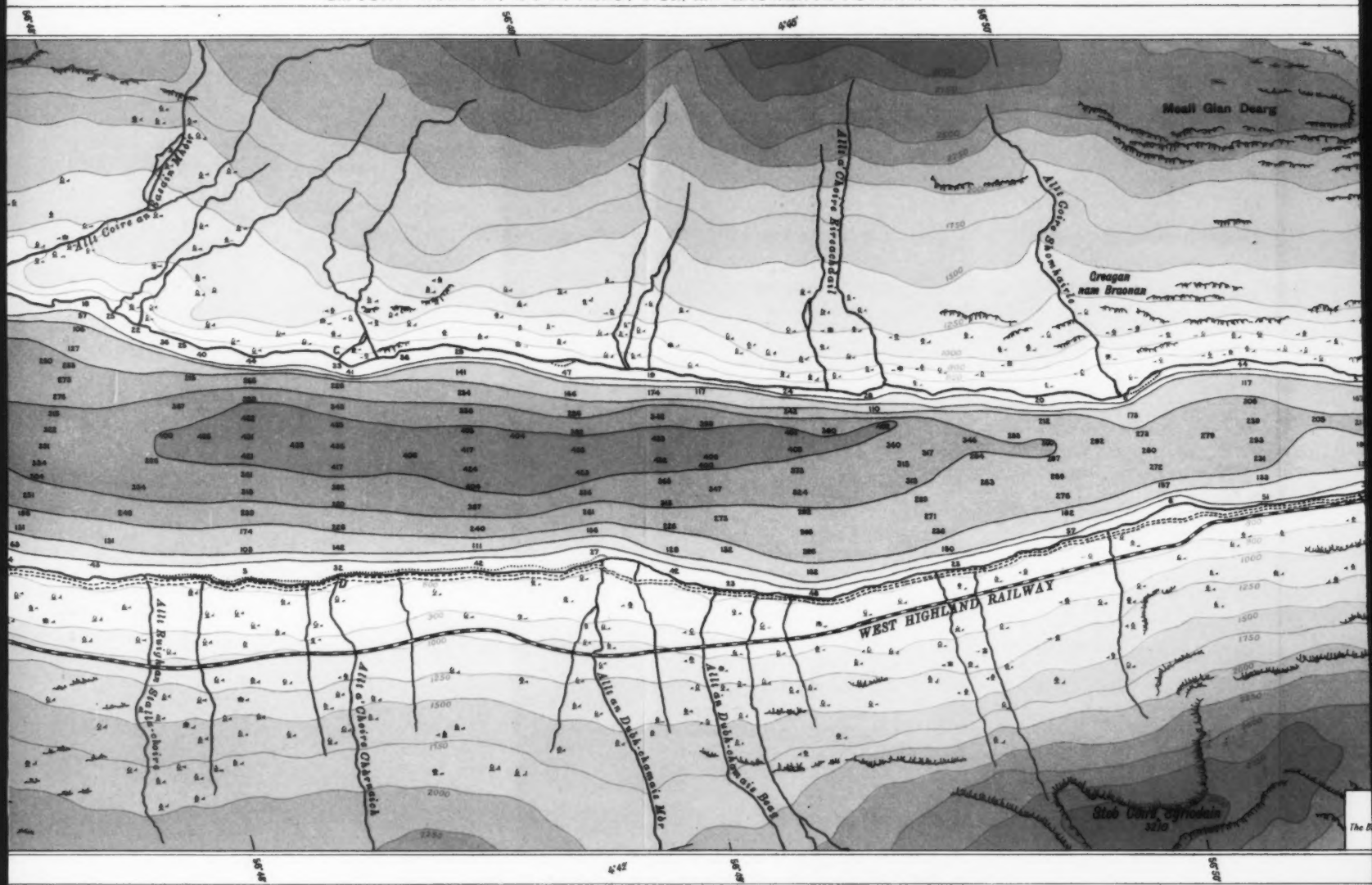

LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

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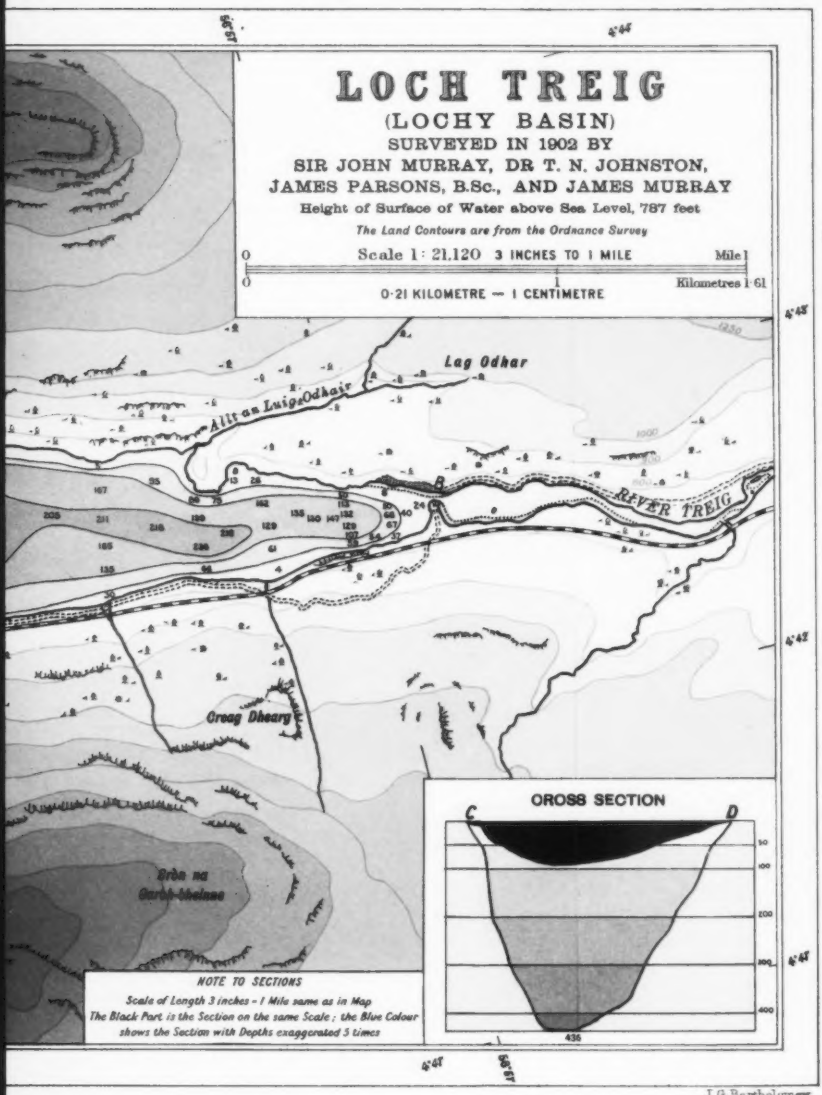

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BATHYMETRICAL SURVEY OF THE LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

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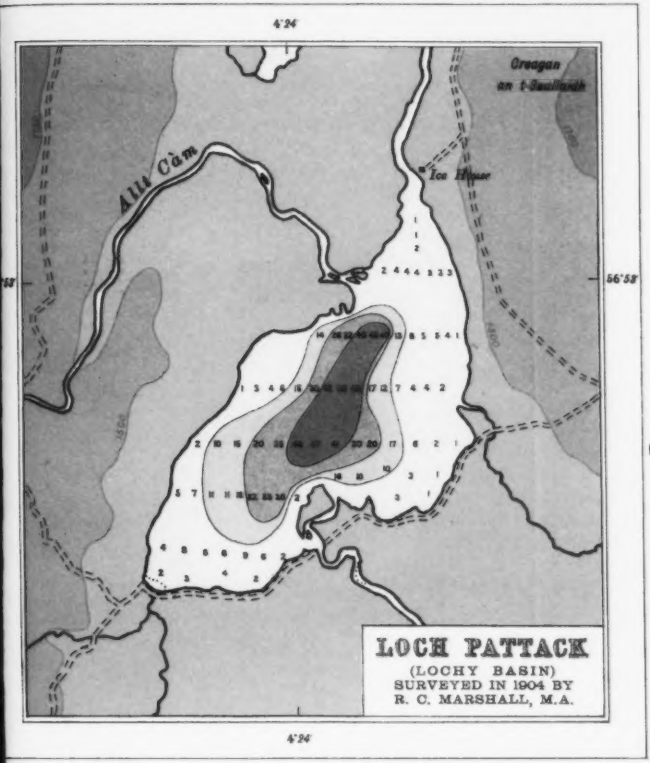


HEIGHTS IN FEET

FEET	METRES
1750	533·4
1500	457·2
1250	381·1
1000	304·8
900	274·3
800	243·8
700	213·4

DEPTHS IN FEET

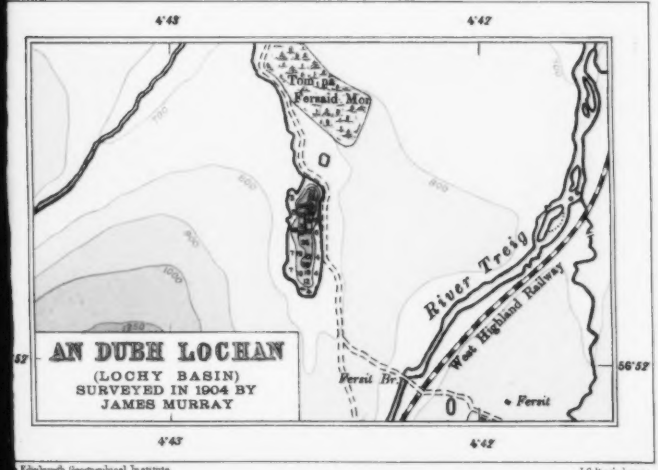
FEET	METRES
10	3·05
20	6·1
40	12·2

0 Scale 1 : 21,120 3 INCHES TO 1 MILE Mile 1

0 Kilometres 1·61

0·21 KILOMETRE — 1 CENTIMETRE

The Land Contours are from the Ordnance Survey



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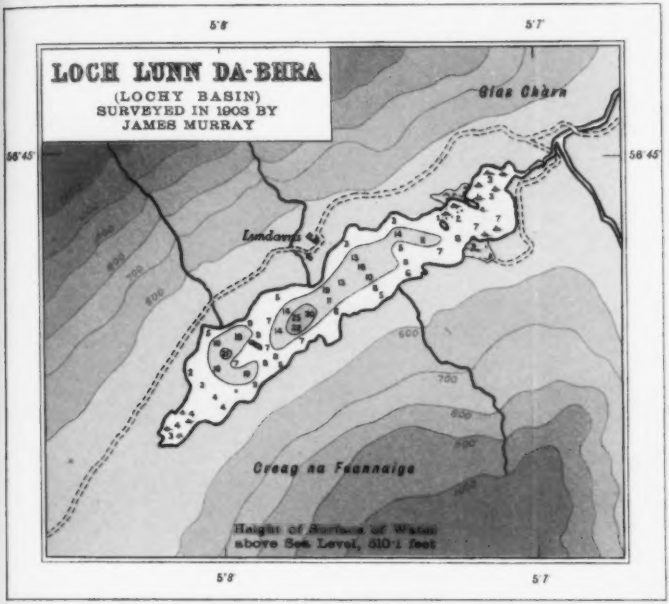

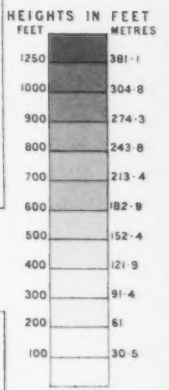

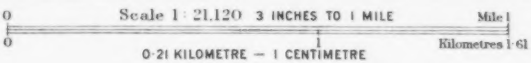

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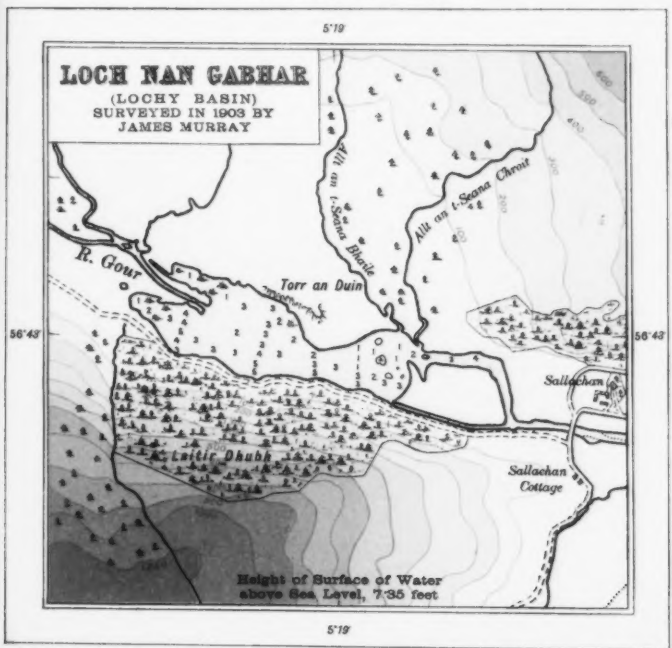

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